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MAMMALS OF NORTHERN COLOMBIA PRELIMINARY REPORT NO. 1: SQUIRRELS (SCIURIDAE)

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IN THIS and succeeding accounts of the mammals collected by the author in northern Colombia during the first 2 years of his tenure of the Walter Rathbone Bacon Traveling Scholarship, those animals requiring special taxonomic treatment will be discussed. The final report on the collection will contain a complete and annotated list of the mammals, a full description of the region and the individual collecting stations, an account of the itinerary, and the general conclusions to be derived from a study of the classification, distribution, and ecology of the mammals of the region. Acknowledgment will be made to the institutions and the many individuals who enabled the author to prepare these accounts.

During the course of the field work special attention was given to the collecting of sciurids. Two species of squirrels were found, and it is almost certain that more do not occur in the region. The first species, the pigmy squirrel, genus *Microsciurus*, is represented by two specimens from the Río San Pedro, near Norosí, Bolívar Department. These are here assigned to *Microsciurus alfari* Allen, the oldest available specific name for the genus. It is unlikely that valid specific differences exist between any of the described forms.

The second species found is represented by 225 specimens. For this, the generally overlooked name of *Sciurus granatensis* Humboldt is applicable. This highly variable species is shown to be the equivalent of most of (if not all) the "species" of the defunct "genus" *Mesosciurus* and liquidates the heretofore admitted genus, or subgenus, *Noto-sciurus* with its single species, *rhoadsi*.

The author expresses his thanks to the authorities of the American Museum of Natural History for the loan of specimens and permission to examine the type specimens in their charge; to the authorities of the Chicago Natural History Museum for the loan of specimens and permission to describe one of the squirrels in their collection; to Charles M. B. Cadwalader, director of the Academy of Natural Sciences of Philadelphia, for permission to examine the type of *Notosciurus*; to J. Kenneth Doult, of the Carnegie Museum, for giving the writer unconditional access to the specimens in his care with permission to report upon them; and to Hermano Nicéforo María, of the Instituto de La Salle, Bogotá, for the gift of valuable specimens of squirrels that are now in the United States National Museum. Deep appreciation is expressed to the members of the staff of the British Museum (Natural History) and of the Muséum National d'Histoire Naturelle, Paris, for the freedom enjoyed by the author in examining the collections of mammals in their charge.

In the lists of specimens, the following abbreviations are used:

A.M.N.H. = American Museum of Natural History.

B.M. = British Museum (Natural History).

C.M. = Carnegie Museum, Pittsburgh.

C.N.H.M. = Chicago Natural History Museum.

M.C.Z. = Museum of Comparative Zoology, Harvard University.

M.N.H.N. = Muséum National d'Histoire Naturelle, Paris.

U.S.N.M. = United States National Museum.

Most color terms mentioned in the descriptions are shown in Robert Ridgway's "Color Standards and Color Nomenclature" (43 pp., 53 pls., Washington, 1912).

SCIURUS GRANATENSIS Humboldt

The characters of the species may be said to be, roughly, those given for the "genus" *Mesosciurus* by Allen (1915, p. 212). Since the time of Allen's monograph, his *Mesosciurus* has been synonymized with *Guerlinguetus*, and this, in turn, has generally been accorded subgeneric rank. Because of the strictly limited geographical scope of this work, the description of the species in the following pages is given largely in terms of the subspecies which occur in northern Colombia and northwestern Venezuela (map, fig. 1). Wherever necessary for purposes of comparison, reference is made to the races of outlying areas.

TAXONOMIC HISTORY OF THE MEDIUM-SIZED SQUIRRELS OF COLOMBIA

The first name applied to a squirrel with a Colombian locality is *Sciurus flavus* Linnaeus. It is described on page 64 of the tenth edition of the *Systema Naturae* as "*luteus, apicibus pilorum albis*. . . *Habitat in America*." On page 86 of the twelfth edition, Linnaeus added the habitat "*Cartagenae*" to the description. However,

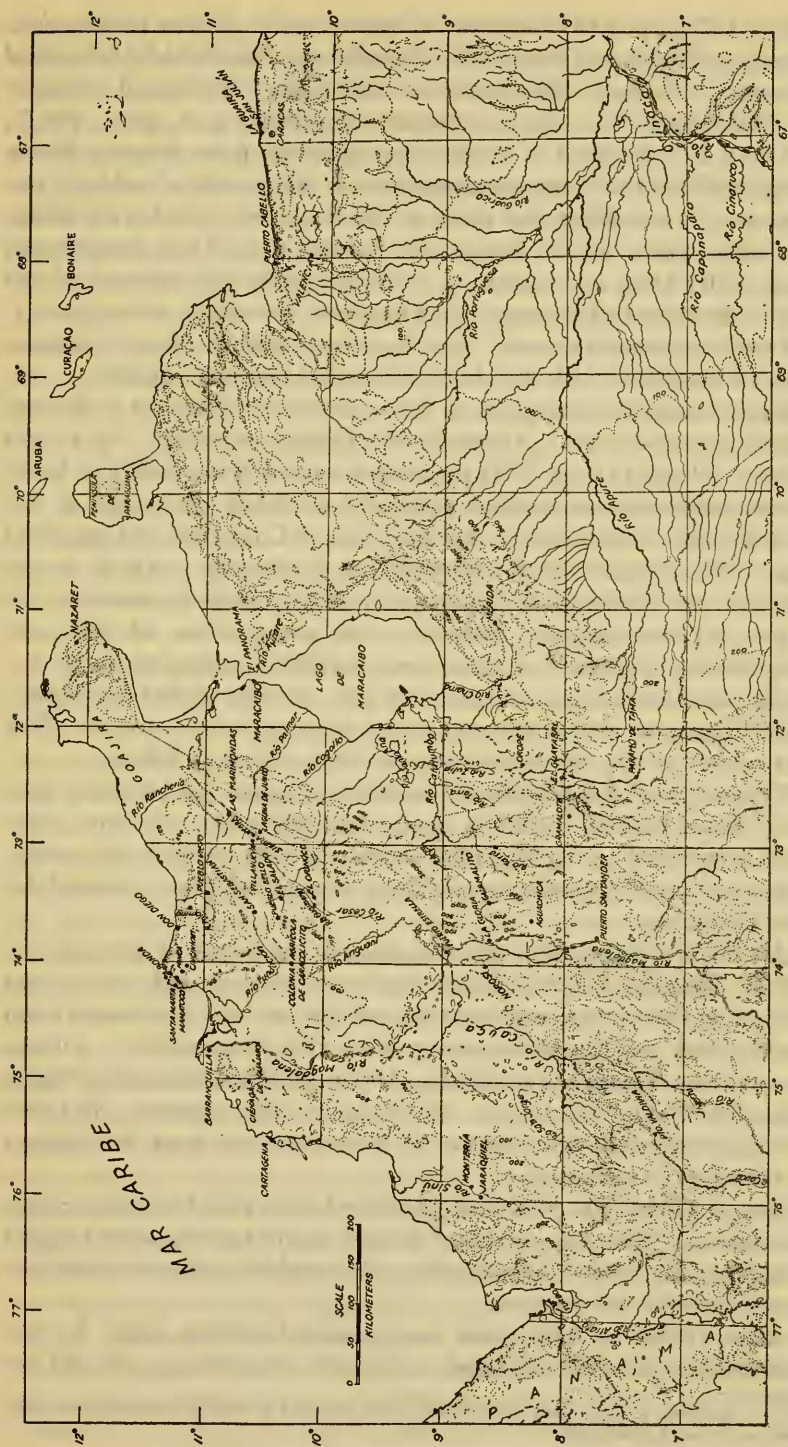


FIGURE 1.—Map of northern Colombia and western Venezuela showing collecting localities (contour intervals, 100, 200, 500, 1,500, 3,000 meters, respectively).

Pennant (1793, p. 148) believed *S. flavus* to be Indian rather than American and recorded it from the "woods near Amadabad, the capitol of Guzarat," India. Humboldt, in describing "l'écureuil orangé" from "Carthagène" as *Sciurus granatensis* (1812, p. 8, pl. 3, No. 7, figs. 1 and 2),¹ declared it to be very different from *Sciurus flavus*. The squirrels of the Cartagena region are orangeous or reddish, not yellow, and, if anything, the hairs of the back are tipped with black, never with white as in *flavus*. It seems then that *granatensis*, unequivocally from our region, is unquestionably the squirrel of the present collection and the same that has been described, subsequently, under various specific names. On the other hand, *S. flavus* Linnaeus cannot be identified with any known South American squirrel.

The next name to be applied to the squirrels of Colombia is *Sciurus variabilis*, proposed by I. Geoffroy St. Hilaire in 1832. Up to the time when Allen (1915, p. 251) formally declared *S. variabilis* to be an indeterminable species, authors generally accepted this name as the earliest for the medium-sized red squirrels of Colombia and adjacent regions. The history of *S. variabilis* is interesting. Allen, in his revision of the Neotropical Sciuridae (1915), refers to most of the literature on the subject. However, his presentation of the case, leading to the rejection of the name *variabilis*, appears to be too strongly based on his personal opinion and, we may be led to suspect, a bias favoring his own conclusions over those of other authors. The salient points of the argument may be summarized as follows:

1. The original description of *variabilis* appears to be quite adequate—indeed, much more so than the description of any other American squirrel up to the time Alston (1878) revised the group. The original series, consisting of three specimens, was collected by Plée in Colombia.

2. Alston (1878, pp. 657, 665) examined the types of *variabilis* in the Paris Museum and concluded that they represented the "oldest name and therefore the one here adopted [for the] red specimens from Colombia and strictly synonymous with Gray's *gerrardi*." Among other squirrels referred to *variabilis*, Alston included one from "Santa Martha," or Santa Marta, the old name for the province that was later combined with the province of Valledupar to form the present department of Magdalena.

3. Bangs (1898, pp. 183–186) identified squirrels from the Santa Marta region, Colombia, as *variabilis* and restricted the type locality to Bonda on the coast. He described *S. variabilis saltuensis* from the Sierra Nevada in the interior.

4. Allen (1899, p. 216), who was prepared with a name for the Bonda squirrel (*bondae*), objected to Bangs's conclusions. He did not

¹ The work consulted, a second issue of the *Mémoire* first published in 1805, *vide* Sherborn, *Ann. Mag. Nat. Hist.*, ser. 7, vol. 3, p. 428, 1899.

agree that Geoffroy's description of *variabilis* fitted the Santa Marta squirrels, and he thought that the type specimens "are much more likely to have come from Western Colombia than from the coast district about Santa Marta." Accordingly, he advanced *saltuensis* to specific rank with *bondae* as a subspecies.

5. Bangs (1900, p. 91) held his ground and insisted that until it could be proved by comparison with the types that he was wrong, his identification of *variabilis* and restriction of its type locality must stand "according to all ruling."

6. Allen (1904, p. 434) summed up the arguments and felt it "safe to assume that the real type locality of *S. variabilis* is the Magdalena River of Colombia, at some point remote from the coast, in the region inhabited by *Ateles hybridus*," the type of which was also collected by Plée. Hence, he argued, *bondae*, having originated in an entirely different region, must differ from *variabilis*.

7. Allen (1914, p. 593) described *S. saltuensis magdalenae* from El Banco, Río Magdalena, at the mouth of the Cesar. This locality is within the area that Allen (1904, p. 435) had thought almost certain to be the "real type locality of *S. variabilis*." He did not return to this question, however, in the description of *magdalenae*.

8. Thomas (1928, p. 590) showed that *magdalenae* was identical with *splendidus* Gray (1842). He identified a specimen from the "Río Cesar, Santa Marta," as perfectly representative of *splendidus*, and referred *bondae* and *saltuensis* to it as subspecies.

The present author has examined in detail the types (two specimens) of *S. variabilis* in the Paris Museum. In addition, he has seen some of the specimens studied by Bangs and Allen, including the type of *bondae*, as well as a considerable amount of new material. In the light of this, the following opinions may be offered: (1) Bangs correctly identified his squirrels as *S. variabilis* (= *granatensis*), and Allen was not justified in renaming them without recourse to comparison with the types; (2) Allen's objection to the restriction of the type locality to Bonda may be sustained and his assumption of its location somewhere up the Magdalena distant from the coast appears valid.

Thus, one might revert to Alston and adopt the specific name *variabilis* were it not for the fact that *granatensis* is the older valid name for the medium-sized squirrels of Colombia. However, the contrastingly colored reddish and black squirrels from La Gloria, Río Magdalena, agree completely with the lectotype of *S. variabilis* and are sufficiently distinguishable from the nearly uniformly orange-colored *granatensis* to warrant recognition of the name *variabilis* as a subspecies. The still paler form of the Santa Marta region may retain the name *bondae*. Furthermore, the squirrels of the Río Cesar, from its head to its mouth at the Magdalena, show small but consistent differences in color from those higher up the Magdalena, at La Gloria,

and they may continue to be known as *splendidus* (*magdalenae*). Additional details concerning the above are given under the appropriate subspecies headings.

Further study of the variation and distribution of *Sciurus granatensis* reveals that other forms, previously considered distinct specifically, grade into it. These are listed and discussed separately. The status of *S. pyrrhinus* Thomas is obscure. Specimens in the United States National Museum from Chanchamayo and La Merced, Peru, agree with the description of *pyrrhinus* externally, but their cranial measurements differ widely and clearly show that they are members of the *Hadroskiurus* group. The author's notes on the type merely indicate that it is a large squirrel, probably of the *Hadroskiurus* group. This species has been considered by Allen (1915, p. 254) a form of his genus *Mesoskiurus* most nearly related to *saltuensis* (= *granatensis*). Other species generally included in the "*Mesoskiurus*" group are *richmondi* and *argentinus*. These are not dealt with here and may be distinct from *granatensis*.

The following additional named forms, listed and discussed in chronological order, are considered synonyms of *granatensis*. Most of these names are retained as valid subspecifically.

Sciurus chrysurus Pucheran (1845, p. 337). This is an immature of *Sciurus hyporrhodus* Gray (1867), which name it replaces as it has been described from the same locality, "Santa-Fé de Bogotá." The type matches perfectly with very small, immature representatives of *granatensis* from the Bogotá region. It has been confused by revisers with the very different *S. rufoniger* described from the same locality by the same author (1845, p. 336).

Sciurus gerrardi Gray (1861, p. 92) described from "New Grenada." The use here of the earlier name *granatensis* for the common squirrels of Colombia eliminates *gerrardi* as a species. Alston (1878, p. 666) had examined the types of both *gerrardi* and *variabilis* and declared them to be exactly synonymous. Thomas (*in* Allen, 1915, p. 240, footnote 1) concurred. By suppressing the name *variabilis*, Allen was compelled to resurrect *gerrardi* as the name for the common red squirrel. After considerable difficulty he decided (1915, p. 308) to restrict the type locality of *gerrardi* to somewhere between the range of the "*zuliae-cucutae* group" and "*baudensis*"; a specimen from the Río San Jorge was considered typical. This must be accepted, and the squirrels of that region may be known as *S. granatensis gerrardi* and distinguishable from the typical form by the redder color and the black-tipped tail, if this last is, indeed, a valid distinction.

Sciurus hoffmanni Peters (1863, p. 654). Examination of specimens from Costa Rica, Panama, Colombia, and Ecuador representing all the forms recognized by Allen (1915) as races of *hoffmanni* and comparison of these with the material which forms the principal subject of

this paper reveal no specific differences. Allen's concept of *hoffmanni*, conforms, in general, to the physical expression of the common species in the middle altitudes of the Colombian and Ecuadorian Andes. Thus, the "remarkable hiatus in distribution in northwestern Colombia and the southern part of Panama" of the typical form of *hoffmanni* that so confused Allen (1915, pp. 212, 219) and later investigators is disposed of.

The distribution of *hoffmanni* as given by Allen (1915, p. 216) is considerably embroiled. It starts in Costa Rica, skips Panama where *chiriquensis* occurs, and the lowlands of northwestern Colombia. It reappears in the Andes of Colombia but with its continuity in the Cordillera Central interrupted by *quindianus*. It is further recorded from the Andes of Ecuador and is said to continue south to Bolivia. However, the recognition of the conspecificity of *hoffmanni* and the other described species in the areas concerned, with *granatensis*, resolves the distributional anomaly into a logical, as well as natural, pattern. It may be possible to reassign most of the Colombian records given by Allen for *hoffmanni* to forms already described from there. His Ecuadorian records are assignable to either *imbaburae* or *söderströmi*. Ellerman (1940, p. 340), aware of the distributional difficulty, lists *söderströmi* as a valid race. The Bogotá form, generally known as *S. hoffmanni hyporrhodus* Gray, is replaced by *S. granatensis chrysurus* Pucheran (q. v.).

Macroxus griseogena Gray (1867, p. 429). Allen (1915, p. 226) listed the original citation as a "composite species," because Gray gave the habitat for *griseogena* as Honduras, Venezuela, Santa Fé de Bogotá, Mexico, Isthmus of Panama, and Volcán de Cartago in Costa Rica. This range does not appear to be too exaggerated, when it is recalled that this form has been considered at various times identical with *hoffmanni* by authors. Even Allen (1915, pp. 212, 224, 228) showed that intergradation took place between the two animals, but he kept the names apart. Thomas (1901, p. 193) fixed the type locality as Venezuela. It is here further restricted to San Julián on the basis of the specimens from this locality recorded by Robinson and Lyon and which are at hand. These authors submitted specimens to Thomas for comparison and they (1901, p. 144) recorded his opinion as follows: "The squirrel is very typical of *S. griseogena* Gray, the specimen No. 102721, being more exactly like the type than any others of the large numbers we have here [in the British Museum]." Further treatment of *griseogena* is given later on in the text where it is demonstrated that it grades into *granatensis* of Colombia.

Sciurus chapmani Allen (1899, p. 16). Described from the island of Trinidad. This squirrel is an extremely small representative of the common species. It is indistinguishable from the squirrels of Cristóbal Colón at the tip of the Paría Peninsula on the Venezuelan

coast opposite the northwestern tip of Trinidad. The range of this form continues west across the arid coast and grades into the slightly larger and darker *griseogena*.

Sciurus (Guerlinguetus) quebradensis Allen (1899, p. 217). Described from Quebrada Seca, east of Cariaco, at the southern base of the Peninsula de Araya, in northern Venezuela. Allen (1915, p. 230) has already treated *quebradensis* as a synonym of *chapmani*. This is rather surprising in view of that author's tendency to split subspecies into genera and subgenera. The locality records of *quebradensis* are of interest. They are evidence of the continuity of the range of the species *granatensis* across the northern coast of Venezuela into Trinidad and indicate that the ranges of *chapmani* and *griseogena* may be contiguous.

Sciurus nesaeus G. M. Allen (1902, p. 93). A topotype at hand from Margarita Island suggests that this squirrel, like *chapmani*, is an insular offshoot of the common species. It appears to have differentiated more from the mainland stock than has *chapmani*. It may be an arbitrary procedure to regard *nesaeus* as a subspecies of *granatensis*, but in the absence of evidence to the contrary its relationship to the continental form is thus best expressed. Allen (1915, p. 233) spoke of *nesaeus* as being "intermediate between its two mainland neighbors, *M. griseogena* and *M. chapmani*."

Sciurus tobagensis Osgood (1910, p. 27). From the island of Tobago, northeast of Trinidad. This form has been considered a race of *chapmani* (= *granatensis*) by Allen (1915, p. 232). Three topotypes at hand confirm its near relationship to *chapmani* as well as its specific identity with *granatensis*. The squirrels of the islands of Trinidad, Margarita, and Tobago are all very closely related and all are *griseogena*-like in appearance. The differences which separate them from each other and from the mainland *griseogena* are nowhere as great as the differences between the coastal Colombian and Ecuadorian forms and their high Andean relatives.

Notosciurus rhoadsi Allen (1914, p. 585, fig. 1). The genotype, and only specimen, is an immature individual of "*hoffmanni*" with the furred portions of the ankles left tucked over the soles of the hind feet through carelessness by the preparator. This condition was described and figured by Allen as the principal generic character. The specimen was brought from the Pagma Forest, Ecuador, by Samuel N. Rhoads and first recorded by Stone (1914, p. 14) as *Sciurus irroratus* Gray. It is quite obviously the same as the other Rhoads squirrels from Mount Pichincha, Ecuador, which Stone described as *Sciurus hoffmanni söderströmi*.

Guerlinguetus griseimembra Allen (1914, p. 589). Examination of the original series, including the type, shows that this small highland

form (like *meridensis*, *q. v.*) grades into the larger *granatensis* of the lowlands through geographically intermediate series.

Guerlingentus candalensis Allen (1914, p. 590). This form is too slightly distinguished from *griseimembra* to warrant its ever being separated from it specifically.

There is appended to this paper a supplementary list of the South American forms of *granatensis* that may be recognized.

COLOR PATTERNS AND INDIVIDUAL VARIATION (TABLE 1)

Among the individuals of the species herein described there are four basic color patterns apparent on the back and sides:

- (1) A more or less uniformly reddish² color phase.
- (2) A more or less uniformly orangeous² color phase.
- (3) An agouti pattern. Results from a mixture of annulations of reddish or orangeous with black on the individual hairs.
 - (a) Pale agouti—with the reddish or orangeous predominating; many of the hairs may lack black bands.
 - (b) Dark agouti—with the black predominating; many of the hairs may be entirely black.
- (4) Contrasting patterns.
 - (a) With either reddish or orangeous on anterior portion of the back and the agouti on posterior portion (and base of tail).
 - (b) As in (a) but with black instead of agouti on rump (and base of tail).
 - (c) As in (a) or (b) but with the agouti, or black, of rump extending anteriorly for varying lengths as a median dorsal band and sometimes even passing forward onto the crown as a cap; the reddish or orangeous of sides, and especially the shoulder regions, are contrastingly defined. The resulting pattern may be designated as either 4ab (contrasted with agouti) or 4ac (contrasted with black).

Most individuals conform closely to one of the above patterns. Some specimens show a combination of two or more of these patterns either in the form of some distinct design or some irregular markings or mottling, while the pattern of others may lie somewhere between two of the basic categories. In practically all populations, however, one or two closely intergrading patterns dominate and the series may be classified accordingly (table 1, p. 34).

The individual hairs of the back and sides may be unicolor to the roots or with gray bases, or they may be ringed with from two to five color bands. Underparts vary from entirely white on belly, chest, neck, throat, forelegs, and thighs to entirely orangeous or reddish. Tail, on upper surface, may be uniformly orangeous or reddish throughout its length or with basal portion agouti or black; the tip or terminal portion may be slightly darker than the bright middle portion, to entirely black; ventral side of tail may be uniformly

² As used herein, "reddish" covers the red-yellow tones shown in Ridgway, where the red appears to be dominant, and "orangeous" where the yellow appears dominant.

colored or may be banded longitudinally in some regular pattern giving a bicolor, tricolor, or quadricolor effect, or it may be irregularly banded, or simply show a mixture of differently colored hairs; individual hairs of tail may be unicolor or show from two to ten bands of color.

No truly melanistic individuals are included among the squirrels described under the subspecies headings. In *Sciurus granatensis chrysurus* of Bogotá a more or less blackish phase appears, with a melanistic individual noted.

MOLT AND SEASONAL CHANGE

Judged from the appearance of individuals in various stages of molt, it appears that the colors and patterns of the new pelage of one season are not necessarily faithful reproductions of those of the corresponding season of the previous year. It seems that the amount of white or red on the ventral surface will vary from season to season in any one representative of a group where both red and white undersides occur; that the color and pattern of an individual may shift from one of the categories listed above to another one if both colors and patterns occur in the population; that an individual with a uniformly colored tail one season may have a black-tipped or distinctly bicolor one the next, provided such variation exists in the group to which it belongs. Such changes appear to represent phases of a long and complex cycle correlated with the physiological changes attending growth, breeding, and senescence, and with the individual or group response to environmental fluctuations.

Such morphological changes are known to occur among mammals of the temperate zones and have been consistently studied. At present the determination of seasonal changes in pelage and color pattern in any species of tropical-zone mammal is difficult and in most cases practically impossible. Nearly all specimens of tropical American mammals in our collections represent small series taken within a very short period of time. Where we do find a large series taken during a period of time covering two or more calendar seasons, we may find also that the locality given on the labels of the specimens represents, in reality, an immense area that harbors a number of diverse populations. Each of these populations, in turn, may be subjected to a different ecological season within the same calendar period.

Among the squirrels of the present collection under study, only one series, that taken from the middle Río Cesar region, lends itself as most nearly suitable for throwing some light upon the question at hand. This series of 66 specimens includes 27 from the Río Guaimaral, a channel of the Cesar, and 39 specimens from El Orinoco, Río Cesar. The names of the localities represent different camps about 5 kilometers apart in the same general area. The squirrels were taken within a radius of 5 kilometers from each camp.

The material from the two stations was collected as follows:

Guaimaral.....	27 specimens.....	Aug. 20–Sept. 28, 1942.
Cesar.....	30 specimens.....	Oct. 3–Nov. 2, 1942.
Cesar.....	9 specimens.....	Mar. 31–April 9, 1943.

In comparing the first 2 groups, which were taken during a continuous period, most apparent is the fact that the second group averages darker (reddish) than the first (orangeous). A comparison of the first 10 adults taken at Guaimaral (August 20–24) with 10 adults taken at Cesar in practically the same length of time 2 months later (October 21–24) reveals the following differences:

Guaimaral: Pelage thin and, in seven specimens, very worn. Nine specimens distinctly mottled orangeous and reddish; the tenth, in old worn pelage, uniformly reddish. No distinct molt line evident.

Cesar: Pelage thick and, in most cases, new throughout the body of each individual. Mottling subdued, the color nearly uniformly reddish in seven specimens, orangeous in two, and mottled orangeous and reddish in one.

The specimens taken during the intervening time show, in general, the following succession:

(1) A mixture of new orangeous and old reddish pelage; and old reddish pelage giving way to new orangeous pelage; molt line present (to September 6).

(2) New orangeous pelage becoming reddish (to October 12).

(3) Prime red pelage with a few individuals in new orangeous pelage (to November 2).

The third and last group taken from the Cesar (9 specimens, March 31–April 9) confirms the above succession of an actual change in color phase. This group agrees with the Guaimaral series in being paler than the other Cesar group. It shows the reddish pelage old and worn being replaced by a new orangeous pelage.

In connection with the author's observations on the rainfall at these collecting stations, the following conclusions may be drawn: During the height of the rainy season (October and November) the pelage is prime, reddish. In the ensuing dry season (December–April [May and June]), the pelage becomes old and begins to be replaced by a new orangeous one. The condition during the rainy season which follows (to August) is not known but, judged from what follows, the new orangeous becomes prime reddish. During the short dry season, or "veranillo" (August, September), the reddish begins to molt and is replaced by new orangeous, which in turn, when the rainy season is resumed (September), becomes prime reddish again. To this may be added that the color of the tail appears to undergo the same changes but lags, in time, behind those of the rest of the body.

The mottled condition, so often referred to here and in succeeding pages, may either result from the *molt* of reddish- to orangeous-colored pelage, or the *change* in color from orangeous to reddish, or it may be a characteristic of the individual color pattern quite independent of the first two factors.

Extreme caution must be exercised in attempting to apply the findings from the study of the squirrels of the middle Río Cesar to those of other regions. The Cesar series represents a fairly homogeneous group with the variation in color restricted to the conditions between uniformly reddish and uniformly orangeous. The squirrels taken at three different stations in the Sierra Nevada de Santa Marta show a variety of color patterns and combinations of patterns but do not supply clues that may lead one to suspect that their differences in pelages, color phases, and color patterns are related to changes in the environment of any one of the localities. The three series are listed with the pertinent data:

Colonia Agrícola. Altitude 335 meters above sea level. 17 specimens from January 15 to March 2, 1942. Period rainy with a few clear days. All conditions of color, pattern, and pelage as noted for the subspecies *agricolae*.

Pueblo Bello. Altitude 1,067 meters. 17 specimens from April 24 to May 17, 1942. Period very rainy. All conditions of color, pattern, and pelage as noted for the subspecies *saltuensis*.

El Salado. Altitude 430 meters. 19 specimens from June 23 to July 21, 1942. Dry period with occasional rains. Agree with the Colonia Agrícola series of *agricolae* and show an even wider range of variation.

SCIURUS GRANATENSIS GRANATENSIS Humboldt

Sciurus granatensis HUMBOLDT, Recueil d'observations de zoologie et d'anatomie comparée, vol. 1, p. 8, pl. 3, No. 7, 1811 (1812); *ibid.*, vol. 1, livr. 1, 1805, first issue, *vide* Sherborn, Ann. Mag. Nat. Hist., ser 7, vol. 3, p. 428, 1899.

Type.—No type specimen preserved. Name based on description of the squirrels observed and the original figures (*op. cit.*) of tongue, larynx, and hyoid bone of an individual dissected in the field.

Type locality.—Cartagena, Department of Bolívar, Colombia.

Distribution.—Department of Atlántico, and Province of Cartagena, northwest Bolívar Department, Colombia.

Characters.—Upperparts orangeous, underparts sharply defined white. Paler than *splendidus* and *gerrardi*; slightly smaller and more red than *bondae*; more uniformly orangeous than *morulus* and *salaquensis*.

Coloration.—The series of six males and eight females from Ciénaga de Guájaro, 53 kilometers northeast of Cartagena, are considered typical. In most individuals of this series the entire surface of the dorsum ranges from nearly uniformly orange to orange-rufous, and mars orange in the darkest specimens; hairs orange with or without fine black tips, becoming paler toward the gray bases. In two specimens lower back mixed orange and black. Sides of body and limbs like back or more yellow, and without black; chin and sides of face paler than sides; crown like back; nape like crown or slightly darker and contrasting with crown and back. Tail with basal portion faintly mixed with black to nearly entirely black, tip like middle

orange portion of tail, or from slightly darker to entirely black; undersurface of tail may be uniformly colored, bicolor or tricolor with black forming the middle band.

The two specimens with the contrastingly dark rumps and black-tipped tails mentioned above stand out sharply from the other members of the series. These show a color pattern, recalling that of the figure of the type of *gerrardi*.

Measurements.—See table 2.

Remarks.—The section containing the original references to *Sciurus granatensis*, nearly lost in Humboldt's "Memoire sur l'Os Hyoïde et le Larynx des Oiseaux, des Singes et du Crocodile," is here quoted in full:

Ayant vécu pendant plusieurs années presque constamment à l'air libre, et entouré d'animaux exotiques, j'ai été étonné de la perfection avec laquelle quelques mammifères imitent la voix des oiseaux: c'est le cas de quelques écureuils et des petits singe sapajous. En ouvrant le larynx de ces animaux, j'ai été frappé de l'analogie qu'ils présentent avec ce que M. Cuvier a découvert dans le larynx inférieur des oiseaux. Que l'on compare dans mes dessins l'organe de la voix du *pelecanus olivaceus* avec celui du petit titi du Darien (*Simia oedipus* de Brisson) et avec celui de l'écureuil de Carthagène, qui est très-différent du *Sciurus flavus*, et qui approche assez du *sciurus erythraeus* de Pallas: on pourroit confondre le larynx du petit singe siffleur avec celui de l'écureuil orangé, et les même poches (pl. 3, Nos. 7, 8) que l'oiseaux cache dans son larynx inférieur, se trouvent dans le larynx supérieur de ces mammifères.

Sciurus granatensis does not emit a birdlike call. What Humboldt must have had in mind is the quickly repeated clucking sound the squirrel makes when "scolding" or "chattering."

Specimens examined.—Ciénaga de Guájaro, 14 (U.S.N.M.).

SCIURUS GRANATENSIS BONDÆ Allen

Sciurus variabilis variabilis, BANGS, Proc. Biol. Soc. Washington, vol. 12, pp. 184, 186, 1898 (*nec* Geoffroy); Proc. New England Zool. Club, vol. 1, p. 91, 1900.

Sciurus saltuensis bondæ ALLEN, Bull. Amer. Mus. Nat. Hist., vol. 12, p. 213, 1899; vol. 20, p. 432, 1904.

[*Sciurus splendidus*] *bondæ*, THOMAS, Ann. Mag. Nat. Hist., ser. 10, vol. 2, p. 590, 1928.

Holotype.—Adult female, skin and skull, A. M. N. H. No. 152334; collected July 1899, by Herbert H. Smith.

Type locality.—Bonda, at the base of the northwestern corner of the Sierra Nevada de Santa Marta, Colombia; altitude about 50 meters.

Distribution.—Base and lower levels of the northwestern slope of the Sierra Nevada de Santa Marta.

Characters.—Palest of the Sierra Nevada de Santa Marta squirrels; paler than *granatensis*; larger than *saltuensis*.

Coloration.—The original description is lengthy and quite adequate, especially in pointing out the variations in color. Exception is taken,

however, to the interpretation of these variations. Allen (1899, p. 213) described these mainly in terms of a "winter or breeding pelage" and a "summer or postbreeding pelage," yet the specimens upon which these descriptions could be based clearly include all the 36 specimens taken during July (*op. cit.*, p. 214). Ten topotypes that Allen originally described as being in the "annulated olivaceous phase" and possibly corresponding to the "summer or post-breeding pelage" were taken on the following dates: January 5, February 5, March 25, March 27, June 22, July 3, 13, 19, 20, and one without date. These specimens are now in the collection of the United States National Museum; they represent a fairly uniformly colored series. They are redescribed as follows:

Back capucine yellow or xanthine orange to orange-rufous more or less ticked with black. In some specimens the hairs of the whole dorsum are tipped or annulated with black (pale agouti, pattern 3a), in others only the hairs of the posterior half of the back are conspicuously tipped and annulated with black (pattern 4a) and still others with the grizzled rump and median dorsal band contrasting with the clearer orange of the shoulders (pattern 4ac). Except for the white ventral portions, forelegs nearly uniformly orange to xanthine orange, the hind legs like rump or nearly uniformly orange. Sides of body like back but with an orange lateral line sharply defining the white underparts. Upper surface of tail xanthine to mars orange, beneath faintly bicolor to distinctly so, or weakly tricolor with black forming the middle band.

Remarks.—Additional specimens examined, taken at Bonda, Minca, Mamotoco, and Cincinnati during January, June, July, and August, agree with the above description except for two adults and one immature collected by Carriker at Cincinnati and Minca, respectively, which agree with *saltuensis* in color. Allen (1904, p. 431) quoted H. H. Smith, who collected the type series as well as specimens identified as *saltuensis*, as follows:

"Common, ranging from sea-level to 6,000 feet or higher. As shown by Dr. Allen (this Bulletin, XII, 1899, pp. 214-216) the color of the upper parts varies from red, more or less bright, to dark olivaceous; he considers the former a breeding and the latter a summer or postbreeding pelage. My strong impression however, is that the depth of coloring is connected in some way with the habitat. We observed that specimens shot near sea level (*Sciurus saltuensis bondae*) were generally red, no matter in what month they were found; while those from the mountains (*Sciurus saltuensis*) were commonly dark at all seasons; the rule, however, is not invariable, as we have some dark ones from near the coast and a few bright red ones from the higher mountains. At Minca (2,000 feet) the two varieties were about equally common in May. It may be well to note that our first collections were from Bonda, and nearly all the squirrels were red; as dark ones were brought in we noted the difference and always saved such specimens if we could, while often rejecting the red ones. Consequently, the collection does not give a correct idea of their relative abundance.—H. H. S."

Specimens examined.—Thirty. Bonda, 16 (5, including type, A.M.N.H.; 10, U.S.N.M.; 1, C.M.); Minca, 7 (C.M.); Cincinnati, 5 (C.M.); Mamatoco, 1 (C.M.); "Santa Marta Mts.," 1 (U.S.N.M.).

SCIURUS GRANATENSIS SALTUENSIS Bangs

Sciurus variabilis saltuensis BANGS, Proc. Biol. Soc. Washington, vol. 12, p. 185, 1898.

Sciurus saltuensis ALLEN, Bull. Amer. Mus. Nat. Hist., vol. 20, p. 431, 1904.

Mesosciurus saltuensis saltuensis ALLEN, Bull. Amer. Mus. Nat. Hist., vol. 34, p. 247, 1915.

[*Sciurus splendidus*] *saltuensis* THOMAS, Ann. Mag. Nat. Hist., ser. 10, vol. 2, p. 590, 1928.

Holotype.—Adult female, skin and skull, M.C.Z. No. 8144; collected March 26, 1898, by W. W. Brown, Jr.

Type locality.—Pueblo Viejo, Río San Antonio, northern slope of the Sierra Nevada de Santa Marta, Magdalena, Colombia; altitude 853 meters.

Distribution.—From near sea level to approximately 2,000 meters on the northern base and slopes of the Sierra Nevada de Santa Marta, south through the mountains to the southern slopes at altitudes ranging between 1,000 and 2,000 meters. The type locality, on the northern slopes of the mountains, is situated at an altitude considerably less than the 8,000 feet given for it by Brown and cited by Bangs in the original description.

Characters.—Darkest and smallest of the Sierra Nevada de Santa Marta squirrels, with thicker and longer pelage.

Coloration.—The subspecies has been well described by Bangs and by Allen. The specimens described below were taken on the southern slopes of the mountains.

PUEBLO BELLO (9 males and 8 females): The series shows a continuous gradation between *saltuensis* and *agricolae* (*nomen novum*) from the type locality and from El Salado. It ranges from four specimens more or less uniformly mars orange (except for white ventral parts) with a very light ticking of black on the back, through individuals with increasing amounts of black, to one uniformly dark agouti with a heavy black median dorsal band and black fore and hind feet. The intermediate agouti individuals with contrasting shoulder regions exhibit a bright reddish lateral line. With the increasing amount of black on the dorsum, some of the hairs become entirely black while the contrasting color of the annulated hairs becomes increasingly yellower. The tails are fairly uniformly orangeous or reddish above, except for the basal portions which agree with the rumps; beneath they range from uniformly colored to bicolor and tricolor.

Remarks.—Two specimens of *saltuensis* from Cincinnati and Don Diego (collected by Carriker) show the color of *saltuensis* with the

short, stiffer pelage of *bondae*. Five other Cincinnati specimens of the same series have been assigned to *bondae*. The region in question is one where intergradation between the two races may be expected. In the eastern, higher parts of Cincinnati, *saluensis* should occur while the lower, western part, is the habitat of *bondae*. The appearance of both reddish and dark agouti individuals of *saluensis* near the coast (see *bondae*, *antea* p. 13) is duplicated in Pueblo Bello, which is well in the interior of the mountains and distant from the coast. However, the tendency in the Sierra Nevada is for the squirrels to become agouti and progressively darker with the increase in altitude. The squirrels seen above 2,000 meters altitude in the vicinity of San Sebastián are blackish. Of the four more or less uniformly reddish specimens of the Pueblo Bello series described above, two are immature, one is subadult.

Specimens examined.—Twenty-four. Pueblo Viejo, 2 (C.M.); Minca, 1 (C.M.); Cincinnati, 2 (C.M.); Don Diego, 1 (C.M.); Palomino, 1 (U.S.N.M.); Pueblo Bello, 17 (U.S.N.M.).

SCIURUS GRANATENSIS AGRICOLAE, new subspecies

Holotype.—Adult male, skin and skull, U.S.N.M. No. 279775; collected March 1, 1942, by Philip Hershkovitz; original No. 208.

Type locality.—Colonia Agrícola de Caracolicito, Río Ariguaní, on the southern slopes of the Sierra Nevada de Santa Marta, Department of Magdalena, Colombia; altitude 335 meters.

Distribution.—Southern and eastern slopes of the Sierra Nevada de Santa Marta at altitudes ranging between 200 and 1,000 meters.

Characters.—Size as in *bondae* but darker, redder; larger, paler, with less black than *saluensis*; smaller, less uniformly colored, more agouti, than *splendidus*.

Coloration of holotype.—Back and crown mars orange lightly ticked with black; hairs tipped black, broadly banded mars orange subterminally and becoming paler, yellower toward the gray bases. Sides of body, neck, fore and hind limbs, except for white ventral portions, mars orange, the hairs becoming paler toward the base. Sides of face, rostrum, chin, ochraceous-buff ticked with black, more tawny beneath the eyes. Underparts white as usual. Tail above burnt sienna, beneath weakly defined tricolor, the hairs yellowish basally, black medially, burnt sienna terminally.

Measurements of holotype (in millimeters).—Head and body, 238; tail, 240; hind foot, 60; ear, 30; condylobasal length, 51.6; zygomatic breadth, 32.5 (approximate); length of nasals, 17.0; interorbital constriction, 18.7; postorbital width, 18.7; width of braincase, 23.9; alveolar length of molar row, 10.0.

Coloration of the paratopotypes (9 males, 7 females).—The series exhibits the two dominant color phases in many forms; some specimens

are mottled with the orangeous and reddish colors, others are either reddish or orangeous with hairs of rump, nape, and crown annulated with black (4a, see p. 9), still others with the annulated hairs of rump extending forward as a weak median dorsal band (4ac). Basal portion of tails like rump, remainder, on upper surface, orange-chrome or orange-rufous to mars orange; hairs of undersurface with lighter basal portions comparatively narrow and sometimes with narrow black subterminal bands. Underparts as usual but one specimen with the white of the thighs produced downward as a line for the entire length of the foreleg and continued as a white fringe on the outer side of the foot; the feet themselves are haired white on the dorsal surface for half their distal length; the soles, except for a narrow inner portion, are unpigmented.

EL SALADO (10 males, 10 females): In the main, agree with the above but show greater extremes of variability. Here the tendency is to throw into sharper relief the combinations of the two color phases and of the various color patterns. Some of the specimens are quite like the topotypes, others merge into the series of *saltuensis* from Pueblo Bello, and others agree with *splendidus* from the middle Río Cesar. In one specimen, the tail, on the ventral surface, is broadly bicolor; the tails of two others whose body colors conform roughly to pattern 4ac (p. 9) are distinctly tricolor.

Remarks.—Gradation between such extremes as the large red squirrel of the Cesar (*splendidus*) and the smaller blackish one of the Sierra Nevada (*saltuensis*) is clearly demonstrated by the geographically intermediate *agricolae*.

Specimens examined.—Thirty-seven. Colonia Agrícola de Caracolicito, 17 (U.S.N.M.); El Salado, 20 (U.S.N.M.).

SCIURUS GRANATENSIS SPLENDIDUS Gray

Sciurus splendidus GRAY, Ann. Mag. Nat. Hist., vol. 10, p. 263, 1842.

Sciurus saltuensis magdalenae ALLEN, Bull. Amer. Mus. Nat. Hist., vol. 33, p. 593, 1914 (El Banco, Río Magdalena).

Mesosciurus saltuensis magdalenae ALLEN, Bull. Amer. Mus. Nat. Hist., vol. 34, p. 251, 1915.

Sciurus splendidus, THOMAS, Ann. Mag. Nat. Hist., ser. 10, vol. 2, p. 590, 1928 (*S. saltuensis magdalenae*=*S. splendidus* Gray).

Holotype.—Specimen of unknown sex and habitat, from the collection of the Museum of the Earl of Derby and now preserved in the Liverpool Free Public Museum.

Type locality.—Unknown. Here fixed on the banks of the Río Cesar near its confluence with the Magdalena. Determination based on the identification by Thomas of a squirrel from the Río Cesar "as perfectly representative of [*splendidus*]," and on considerable other material from the Cesar Valley.

Distribution.—The valley of the Río Cesar, possibly extending northward to the Guajira Peninsula and the lowlands on the east side of the Río Magdalena from its junction with the Cesar, downstream possibly to its mouth.

Characters.—More or less uniformly colored reddish or orangeous on back and sides, underparts white; darker than *granatensis*; paler than *variabilis*, without the heavy suffusion of black on back, the tail fairly uniformly colored. Size as in *variabilis*; larger than *granatensis*.

Coloration.—Each of the series assigned to *splendidus* is described under the heading of its locality.

PUERTO ESTRELLA (3 specimens): Pelage thin, hairs comparatively short and stiff; back, sides, and tail, mars orange with a slight mottling of burnt sienna, the hairs without black tips or annulations; sides of face xanthine orange; underparts white as in *granatensis*. The series is practically topotypical of both *splendidus* and *magdalenae*.

MIDDLE RÍO CESAR (36 males and 30 females, from El Orinoco and Río Guaimaral): Back orange-rufous to mars orange and burnt sienna with hairs less red toward their bases and with or without fine black tips. Crown, ears, sides of body and neck, throat, fore and hind limbs on outer sides like back. Tail generally like back, the hairs orange at base, redder terminally, sometimes a dark subterminal band on hairs of distal one-fifth to one-half of tail. Rostrium, cheeks, and chin orange to xanthine orange. Belly, chest, and ventral surface of neck sharply defined white; inner sides of upper arms and hind legs to varying lengths white, remainder of limbs like sides. The Río Guaimaral series, on the whole, averages slightly paler than the El Orinoco series.

Two color phases are represented here: the lighter one is orange-rufus; the darker, mars orange (or like burnt sienna if the fine black tips of the hairs are taken into account). Some individuals are uniformly of one color or the other; other specimens may be irregularly mottled with both colors or, as in one specimen, the paler anterior half of the back is separated from the darker posterior half by a molt line. In a few specimens there is an indication of a fine dark ticking, or agouti, on the rump. Occasionally, spots of orange appear on the white of the undersurface. There may be a few white hairs interspersed over the back. The tendency toward a tricolor pattern on the underside of the tail is very weak. In the majority of individuals even a bicolor effect is nearly suppressed, owing to the very short paler basal portions of the hairs.

VILLANUEVA (3 males, 2 females): Back, sides, crown, and limbs except for white ventral portions, xanthine orange mottled or mixed with mars orange; one specimen with large irregular patches of mars orange. Tail, above and below, fairly uniformly orange-rufous or mars orange but with slightly darker tips in two specimens. Sides

of face and upper part of throat with more yellow. Underparts with the usual white pattern.

NAZARET (1 male): A single specimen, without skull, taken in May 1941 by Wetmore and Carriker, is slightly paler than the palest of the Villanueva series. It may represent an isolated race at the tip of the Guajira Peninsula, or simply the continuation of the tendency of *splendidus* to become paler from south to north.

Remarks.—This subspecies is characterized by a greater uniformity in color and pattern over a greater number of specimens than any of the other forms considered here. The race shows a marked color gradient following geographical lines. From the reddish phase found at the mouth of the Cesar the animal becomes progressively paler upstream. In the middle Cesar both the reddish and the orangeous phases appear. Farther upstream, at the head of the river, the squirrels show both the reddish and orangeous phases but in paler tones than those lower down. Finally the orangeous individual from the tip of the Guajira Peninsula is the palest of all.

A description of the seasonal change in pelage and color in the Middle Cesar series has been given under another heading.

Specimens examined.—Seventy-five: Puerto Estrella, 3 (U.S.N.M.); El Orinoco, Río Cesar, 39 (U.S.N.M.); Río Guaimaral, Río Cesar, 27 (U.S.N.M.); Villanueva, 5 (U.S.N.M.); Nazaret, 1 (U.S.N.M.).

SCIURUS GRANATENSIS VARIABILIS I. Geoffroy

Sciurus variabilis I. GEOFFROY, Mag. Zool., Paris, vol. 2, Cl. 1, pl. 4, 1832.

(For complete synonymies see text references and Allen, 1915.)

Lectotype.—Adult male, M.N.H.N. No. 534 (No. 307 in type catalog); collected by Plée in 1826.

Type locality.—Originally said to be either the Antilles, the United States, or Colombia. The wooden stand upon which the type is mounted bears the legend "Colombie." Here restricted to La Gloria, right bank of the Río Magdalena about 45 kilometers above the mouth of the Cesar; altitude approximately 45 meters.

Distribution.—In the Department of Magdalena, the Río Magdalena Valley between the bases of the Cordilleras Oriental and Central, from La Gloria south.

Characters.—Larger, darker, with more black on dorsum than *granatensis*; contrastingly colored black and reddish, underparts sharply defined white, basal portion of tail black, terminally reddish above, mixed black and red beneath, tip reddish.

Measurements.—See table 2, page 38.

Coloration.—The colored figure of the type of *variabilis* shows poor draftsmanship and an unhappy selection and combination of colors. Nevertheless, this figure, together with the original description, can

leave no doubt as to the identity of this squirrel. The actual type agrees so well with the specimens from La Gloria as to make it seem that it had originally been taken in the same area. Thus, Allen's surmise (1904, p. 434) regarding the probable habitat of *variabilis* appears to be confirmed.

In the Paris Museum there are but two specimens of the three types described by Geoffroy. Both are mounted on wooden stands and are listed by Rode (1943, p. 382) in his catalog of the types of mammals in the Paris Museum. The cotype, a female, is paler and lacks the black along the back and on the thighs noted in the lectotype. Unless this difference is a result of fading it is possible that this specimen was taken at a stopping point, along the Magdalena, other than where the lectotype was discovered. It is questionably identified with *variabilis*. The following description of the series of three specimens from La Gloria is completely representative of the lectotype:

LA GLORIA (2 females, 1 male): Dorsal surface from crown to basal fourth of tail, mars orange to burnt sienna mixed with black; gray crinkly bases of hairs of anterior half of back followed by a broad band of black, a narrower band of mars orange, tips black; posterior half of back with more black, the hairs entirely black or with one or two narrow orange rings between broad black bands; in one of the females rump and basal fourth of tail appear entirely black. Sides of body and limbs with less black than upper parts, especially at tips of hairs. White underparts sharply defined by a lateral line of mars orange; white of ventrum extends along inner side of forelimbs to elbows and on inner sides of thighs. Tail above orange-rufous to mars orange, the basal fourth nearly entirely black; undersurface mixed orange and black basally in all specimens, terminally nearly uniformly orange in the male, mixed black and orange in one of the females, and bicolor, the hairs with paler basal portions, in the other female.

AGUACHICA (2 females): Like the specimens from La Gloria. Median dorsal band wide on posterior half and extends over crown and proximal one-third of tail; lateral line distinct; fore and hind feet reddish.

Remarks.—Some knowledge of the itinerary of Plée would be of considerable interest. We know little of his explorations in tropical America beyond the reference to his name as the collector of certain animals. As it had already been generally conceded by authors (see Allen, 1904, p. 435) that the squirrel in question, as well as *Ateles hybridus*, was collected by Plée somewhere along the Río Magdalena, the writer attempted to secure examples of these during the course of his field work in northern Colombia. Representatives of *Ateles hybridus* were taken at four localities. Kellogg and Goldman, in their revision of the spider monkeys (1944, p. 25), found that the animal

from La Gloria, Río Magdalena, "appears to be typical." As is shown, the squirrels taken at the same locality are typical. Those taken on the opposite side of the river at the northern base of the Cordillera Central are quite distinct and on the basis of the original description and figure could not be identified with *variabilis*. The squirrels from a short distance lower down the Magdalena, at the mouth of the Cesar, also differ, though to a lesser degree, from the original description as well as from the typical specimens. They are uniformly reddish, lacking the black on the back and tail. Those from near the mouth of the Magdalena (Ciénaga de Guájaro) are typical *granatensis* and even paler than the Río Cesar squirrels.

On the basis of present material it appears that *variabilis* has closer affinities with the squirrels of the Cordillera Oriental than with those of the lowlands farther down the Magdalena. The series of *tarrae* (*nomen novum*) from Guamalito in the Cordillera Oriental east of La Gloria are intermediate in all characters between *variabilis* and topotypes of *tarrae* described from the opposite side of the range. Higher up the right bank of the Magdalena, in the Department of Santander, *variabilis* gives way to squirrels with red bellies and black-tipped tails, quite characteristic of *zuliae*.

Specimens examined.—Seven. Lectotype and cotype (M.N.H.N.); La Gloria, 3 (U.S.N.M.); Aguachica, 2 (C.M.).

SCIURUS GRANATENSIS NOROSIENSIS, new subspecies

Holotype.—Adult male, skin and skull, U.S.N.M. No. 279949; collected June 26, 1943, by Philip Hershkovitz; original No. 2150.

Type locality.—Norosí, Mompós, Department of Bolívar, Colombia; altitude 120 meters.

Distribution.—In the Department of Bolívar, the base and lower eastern slopes of the Cordillera Central to the west bank of the Río Magdalena.

Characters.—Bright agouti, with relatively weakly contrasting shoulder regions, underparts reddish; upper parts paler, with less black, and underparts redder, than *zuliae* and *chrysurus*.

Coloration of holotype.—Dorsal surface orange-rufous to ochraceous-orange evenly mixed with black; sides of body, shoulder regions, dorsal surfaces of upper arms and thighs with less black. Crown and nape like lower part of back; cheeks, lips, chin ochraceous, orbital ring well-defined orange. Underparts and fore and hind feet orange-rufous to mars orange. Tail above, except for mixed buffy and black basal portion, orange with black of undersurface showing through, beneath tricolor with orange on outer border, black in the middle and mixed black, orange, and buff on inner border.

Measurements of holotype (in millimeters).—Head and body, 245; tail, 233; hind foot, 62; ear, 28; condylobasal length, 52.9; zygomatic breadth, 33.9; length of nasals, 18.5; supraorbital constriction, 18.5; postorbital width, 18.5; width of braincase, 22.6; alveolar length of molar row, 9.1.

Coloration of the paratopotypes (4 males, 5 females).—All individuals of the series agree rather closely with holotype; general pattern of the pale agouti type (3a) with comparatively weak contrast in shoulder regions. Three specimens have a narrow, faintly outlined median dorsal band on lower half of back. Tails reddish on upper surface with the black hairs from beneath tending to show through; patterns on undersides of tails, bicolor, tricolor, and in one specimen, quadricolor. In latter, disposition of colors from outer border to midline is reddish, black, ochraceous, mixed black and ochraceous; individual hairs of middle portion of tail 10-banded, the buffy band at base succeeded by 4 bands of black, each of which alternates with each of 4 bands which become successively redder toward the finely pointed black tip. Underparts uniformly reddish.

RÍO SAN PEDRO (6 males, 4 females): Agree generally, with the type series but average darker due to the greater tendency toward forming a dark median dorsal band. In each of two individuals there is a small narrow patch of white on the chest.

Remarks.—The type locality of the “*hoffmanni*”-like *norosiensis* is but a few kilometers from those of *splendidus* and *variabilis*, both on the opposite side of the Río Magdalena. Nevertheless, *norosiensis* is sharply distinguished from those other two races. Apparently the lower Magdalena is a complete barrier to intergradation between the squirrels of the opposing banks. To show gradation from *norosiensis* to *variabilis* it is necessary to pursue a path along the Central Andes to the upper Magdalena (*chrysurus*), thence across the river and returning northward along the Cordillera Oriental to meet the range of *variabilis* through that of *zuliae*.

Of four specimens taken by H. M. Curran in May 1916, at “Puerto Estrella,” Río Magdalena, at the mouth of the Cesar, three have been considered representative of typical *splendidus*. The fourth differs widely and agrees in every respect with *norosiensis*. It must be concluded that this example was taken on the opposite shore of the river. In this connection it may be mentioned here that among other indications of the importance of the lower Magdalena as a zoogeographic barrier, the author found the marmoset, *Marikina leucopus*, abundant from the Río San Pedro to the very edge of the Magdalena, but completely absent on the opposite shore.

Specimens examined.—Twenty-one. Norosí, 10 (U.S.N.M.); Río San Pedro, above Norosí, 10 (U.S.N.M.); “Puerto Estrella,” 1 (U.S.N.M.).

SCIURUS GRANATENSIS PERIJAE, new subspecies

Holotype.—Adult male, skin and skull, U.S.N.M. No. 279892; collected December 25, 1942, by Philip Hershkovitz; original No. 1230.

Type locality.—Sierra Negra, above Villanueva, on the western slope of the Sierra de Perijá, Valledupar, Department of Magdalena, Colombia; altitude 1,265 meters.

Distribution.—Northern half of the Sierra de Perijá (Cordillera Oriental), Department of Magdalena, at altitudes ranging from approximately 800 to 2,500 meters. At lower altitudes, forms intergrading with *splendidus* on the west, and *maracaibensis* (*nomen novum*) to the east probably occur.

Characters.—Contrastingly colored, darker, with more black and smaller than *splendidus*; paler, with less black than *maracaibensis*; more contrastingly colored, less agouti, than *tarrae* and *meridensis*.

Coloration of holotype.—Pelage thick and soft. Mixed orange and black on lower half of back continued forward as a broad median dorsal band to nape, shoulder region more uniformly orange (xanthine orange); black tipped hairs plumbeous basally followed by successive bands of orange, black and orange, the lower orangeous band less red than the subterminal one, both bands becoming yellower toward posterior portion of body and on head. Sides of body like back but with less black and with broader bands of orangeous. Nose, sides of face, chin, and upper half of throat buffy. Hind legs, except for white ventral portions, mixed orange-rufous and black; forelegs more nearly uniformly orangeous. Belly, chest, neck, and lower half of throat sharply defined white. Tail above mars orange, the proximal portion mixed with black, on underside, the hairs with six bands, the basal black followed by successive bands of yellow, black, orange, black, and broadly orange terminally; the general effect is tricolor with mars orange externally, black medially, mixed black and yellow internally.

Measurements of holotype (in millimeters).—Head and body, 236; tail, 216; hind foot, 59; ear, 29; condylobasal length, 51.3; zygomatic breadth, 33.0; length of nasals, 17.0; orbital constriction, 18.9; post-orbital width, 19.0; width of braincase, 23.5; alveolar length of molar row, 10.1.

Coloration of the paratopotypes (12 males, 17 females).—Most of the specimens, like the holotype, are of the contrasting agouti type. Ticked condition of rump continued forward as a median dorsal band sharply defining the orangeous or reddish shoulder regions. Red annulations of hairs of rump paler than corresponding ones of anterior half of back; in many individuals, these bands are yellowish and, together with the black, give an olivaceous appearance to rump. In some specimens there is a marked concentration of black on median dorsal portion of back. Two individuals are nearly uniformly reddish

on back and sides (xanthine orange to orange-rufous) and quite like specimens from the intermontane valley of the upper Río Cesar. One specimen is nearly uniformly agouti on dorsum and sides and shows a fine narrow black lateral line. Fore and hind feet may be orangeous, reddish, black, or mixed with a combination of these colors. There is a tendency here for the development of weak, pale postauricular tufts. Tails on upper surface orangeous or reddish, the tips, in some, mixed with black; on underside uniformly reddish, bicolor (reddish and orangeous), or tricolor (reddish, black, and either orangeous or mixed as in holotype). Underparts white with a notable tendency for reddish of sides to encroach, especially on belly and limbs.

LAGUNA DE JUNCO, SIERRA DE PERIJÁ (1 female): Specimen taken by M. A. Carriker, Jr., from the same general region as the others but from a higher altitude (8,000–9,000 feet). Like holotype but paler, with less contrasting shoulder regions, feet darker. In color of back, sides and character of pelage, it more nearly resembles representatives of *meridensis* from the Páramo de Tamá than any of the topotypes of *perijae*.

LAS MARIMONDAS (8 males, 8 females): The series was taken on the summit and both slopes of the Montes de Oca (Sierra de Perijá), at altitudes ranging from 800 to 1,500 meters. It includes examples from both the Río Ranchería and the Lake Maracaibo drainage systems. All individuals are of the contrasting type (4ab and 4ac, see p. 9). The agouti to black of rump extends forward as a well-defined median dorsal band on anterior half of back and continues onto nape and crown. Tails above reddish or orangeous with tips either mixed with black or entirely black; beneath, bicolor (reddish with either black or mixed orangeous and black), or tricolor, more or less as in holotype. Underparts from white as usual but with some patches of reddish to completely reddish; generally the individuals with more black on dorsum show also more black on tails and less white on underparts. One specimen with hind feet white, the color continuous with white line on ventral surface of limbs. Unlike one of the topotypes of *agricolae* with white feet, its soles show only a trace of albinism.

This series represents an intergrading population between the topotypes, *maracaibensis* and *tarrae*. About half of the series, where the contrasting agouti pattern (4ab) predominates, agrees well with average specimens of the type series while individuals of the remaining half, where the contrasting black pattern (4ac) predominates, could be assigned to either *maracaibensis* or *tarrae*.

Remarks.—The high degree of variation in *perijae* is analogous to that of *agricolae* and *saltuensis*, which, together, inhabit approximately the same altitudinal levels of the Sierra Nevada on the opposite side of the Cesar Valley. The lower opposing slopes of the two mountain

systems have been modified by man to the extent that the ecological conditions with the fauna characteristic of the valley, largely prevail. Since collecting in both mountains was done at greatly varying altitudinal levels, the squirrels reflect this in the variability of their coloration and in the length and texture of their pelage. Generally, the paler, more thinly furred individuals were taken at the lowest levels, and the darker, more heavily furred ones at the highest altitudes with a mixture of both kinds in the intermediate zones. As might be expected, in the case of the Sierra de Perijá, where collecting was done on both slopes and on the summit at altitudes between 800 and 2,500 meters, the large series of squirrels taken include individuals difficult to distinguish from the lowland *splendidus* and *maracaibensis*, the middle zone *zuliae* and *tarrae*, and the highland *meridensis*.

Specimens examined.—Forty-seven. Sierra Negra, 30 (U.S.N.M.); Las Marimondas, 16 (U.S.N.M.); Laguna de Junco, Sierra Negra, 1 (U.S.N.M.).

SCIURUS GRANATENSIS MARACAIBENSIS, new subspecies

Sciurus versicolor zuliae, Osgood, Publ. Field Mus. Nat. Hist., zool. ser., vol. 10, p. 47, 1912 (*nec* Osgood, 1910).

Mesosciurus gerrardi zuliae, ALLEN, Bull. Amer. Mus. Nat. Hist., vol. 34, p. 246, 1915 (Río Aurare, Encontrados, and Empalado Savannas specimens, *nec* Osgood).

Holotype.—Adult female, skin and skull, C.N.H.M. No. 18733; collected January 17, 1911, by Osgood and Jewett; original No. 4118.

Type locality.—El Panorama, Río Aurare, a small river emptying into Lake Maracaibo, opposite the city of Maracaibo, Zulia, Venezuela; altitude near sea level.

Distribution.—From the lowlands surrounding Lake Maracaibo and the lower Río Catatumbo westward into the low passes of the Montes de Oca (Sierra de Perijá) of Venezuela and Colombia.

Characters.—Sharply contrasting black and reddish; with more black on upperparts and red on underparts than *perijae*; with more black, the shoulder regions more contrasting, than in *zuliae*.

Coloration of holotype.—Dorsal surface of body black with contrasting orange-rufous shoulder regions; hairs of rump and middorsum entirely black; anteriorly, hairs of dark median band to nape and crown annulated with capucine yellow; sides of face and chin buffy. Sides of body, limbs, and fore and hind feet orange-rufous; inner sides of thighs mixed with black; underparts orange-rufous with a broken white streak on midline of neck and tufts of white on axillae and upper arm. Tail above black on basal and terminal fourths, middle portion orange-rufous, basal one-fourth of undersurface bicolor (black with mixed black and yellow) becoming entirely black at basal third, followed by a middle tricolor portion (orangeous, black, mixed yellow and black) which terminally merges into the wholly black penciled tip.

Measurements of the holotype (in millimeters).—Head and body, 224; tail, 228; hind foot, 55; condylobasal length, 51.3; zygomatic breadth, 32.2; length of nasals, 17.1; supraorbital constriction, 17.9; postorbital width, 17.6; width of braincase, 22.3; alveolar length of molar row, 9.8.

Coloration.—The topotype, a female, is much like the holotype in coloration. It is in old pelage (new in the holotype), shows a broader median dorsal band and a less complicated pattern on undersurface of tail. A male from Encontrados (just below the confluence of the Ríos Zulia and Catatumbo) patterned like the holotype but shows more black on dorsum and deeper red (mars orange) on shoulder regions, limbs and underparts; tail above, black basally, orange medially, terminal third black, beneath black, with a slight mixture of orange medially and basally.

Remarks.—It appears that *maracaibensis* occupies the whole of the lowlands of the Lake Maracaibo Basin. It has been shown that it intergrades with *perijae* in the northern foothills of the Sierra de Perijá. Similarly, it is shown that it intergrades with representatives of *tarrae* (*nomen novum*) and *zuliae*.

Specimens examined.—Three. El Panorama, Río Aurare, Zulia, 2 (C.N.H.M.); Encontrados, Zulia, 1 (C.N.H.M.).

SCIURUS GRANATENSIS TARRAE, new subspecies

Holotype.—Adult female, skin and skull, U.S.N.M. No. 279964; collected July 25, 1943, by Philip Hershkovitz; original No. 2260.

Type locality.—Río Tarra, a small tributary of the upper Catatumbo, San Calixto, Department of Norte de Santander, Colombia; altitude about 200 meters.

Distribution.—In the southeastern portion of the Sierra de Perijá, the upper Río Catatumbo drainage area, west through low passes (to 1,000 meters) to the Río del Carmen drainage system on the western slope; altitudinal range from about 200 meters above sea level on the eastern side of the mountains to about 500 meters on the western side.

Characters.—Darkest of the northern Colombian and Venezuelan races; more uniformly dark agouti, with deeper red underparts and tail than *zuliae* and *maracaibensis*.

Coloration of holotype.—Dorsal surface from back of head to basal fourth of tail both above and below, black ticked with xanthine orange; sides of body and limbs more orange, the orangeous subterminal band of the hairs paler posteriorly than anteriorly; rostrum evenly mixed black and orangeous, sides of face paler, chin ochraceous. Underparts reddish, with xanthine orange on neck, orange-rufous on fore and hind limbs and sides of chest and belly grading to mars orange midventrally. Middle half of tail burnt sienna above, grizzled with burnt sienna, black and yellowish beneath; terminal fourth black both above and below.

Measurements of the holotype (in millimeters).—Head and body, 207; tail, 200; hind foot, 55; ear, 27; condylobasal length, 46.5; zygomatic breadth, 29.5; length of nasals, 16.8; supraorbital constriction, 16.5; postorbital width, 17.7; width of braincase, 22.5; alveolar length of molar row, 9.0.

Coloration of the paratopotypes (3 males, 6 females).—Throughout this dusky series, the pattern of blackish agouti with little contrast on the shoulder regions is consistent. Terminal portions of tails black in all specimens; in one specimen, middle orangeous portion of upper surface heavily mixed with black and limited to an area of about 2 inches in length; on undersurface, this tail is nearly entirely black except at base. In the series, the undersides of the tails may appear bicolor in middle portions with the outer band either black or reddish, or tricolor with an orangeous, a black, and a mixed yellow and black band. Underparts of body entirely reddish or with narrow patches of white along mid line.

This is a well-marked population distinguishable from *zuliae* by the redder (mars orange) sides and underparts, the greater amount of black on dorsum, and by slightly smaller average size. It is difficult to assign this series to any of the other named forms. It may eventually prove to be part of the gradient between *zuliae* and *maracaibensis*.

GUAMALITO (4 males, 3 females): Both geographically and in its characters, this series occupies a position between the topotypes of *variabilis* and *zuliae*. It consists of highly variable individuals with one specimen agreeing well with some of the typical forms of *perijae*, another with *maracaibensis*, though it has large patches of white on the belly. In general, however, the series is most like the topotypes of *tarrae*. Dorsally as dark as the Tarra specimens, but with shoulder regions more contrastingly reddish; ventrally with an approximately equal distribution of white and reddish, the former color persisting over a greater area than latter on throat, neck, chest, midventral line and around genitalia. Tails with more black than *variabilis*, less than in the Tarra series. The specimen, a subadult, agreeing with *perijae*, is orangeous with an even ticking of black spread lightly over the dorsum. The squirrels were taken at altitudes ranging from 600 to 1,000 meters above sea level.

Remarks.—The range of *tarrae* lies between those of *perijae* and *zuliae*, and parallels them in extending from east to west across the cordillera. Apparently, the distributional pattern of each of these forms follows closely the pattern of the fluvial systems in the Sierra. The system is pursued from near the base of the mountains to the divide, thence across to a connecting system on the other side.

Specimens examined.—Seventeen. Río Tarra, 10 (U.S.N.M.); Guamalito, 7 (U.S.N.M.).

SCIURUS GRANATENSIS ZULIAE Osgood

Sciurus versicolor zuliae OSGOOD, Publ. Field Mus. Nat. Hist., zool. ser., vol. 10, p. 26, 1910.

Mesosciurus gerrardi zuliae, ALLEN, Bull. Amer. Mus. Nat. Hist., vol. 34, p. 246, 1915 (part, Orope specimens only).

Sciurus gerrardi cucutae ALLEN, Bull. Amer. Mus. Nat. Hist., vol. 33, p. 592, 1914 (El Guayabal).

Holotype.—Adult male, skin and skull, C.N.H.M. No. 16585; collected March 1, 1908, by Ned Dearborn.

Type locality.—Orope, a small railroad station on the Río Orope, a tributary of the Zulia, near the Colombian border, Zulia, Venezuela; altitude approximately 25 meters.

Distribution.—The upper Río Zulia drainage area in Colombia and Venezuela, south and west across the Cordillera Oriental to the Río Magdalena in Santander; altitudinal range from approximately 20 to 1,050 meters above sea level.

Characters.—Larger, darker, with more contrasting reddish shoulder regions than *griseogena* and *meridensis*, paler, less uniformly dark agouti than *tarrae*, paler with less contrasting shoulder regions than *maracaibensis*.

Coloration.—The four topotypes of *cucutae*, all females, and one female topotype of *zuliae* are at hand. In view of the short distance in the same general region separating the type localities of these two described forms, it is not surprising that they should conform exactly to each other. Apparently Allen based his distinctions on comparisons of the Guayabal specimens with those here described as *maracaibensis* but which he assigned to *zuliae*. In general, the Guayabal series and the topotype are dark agouti with comparatively little contrast in the shoulder regions; posterior half of back more nearly uniformly black than median dorsal band on anterior half. Underparts reddish except in one of the Guayabal specimens which shows a broad band of white on throat and neck, and white on axillae and pubic region. Tail above black basally and terminally, orangeous medially, underside grizzled basally, black terminally, tricolor (orange, black, grizzled) medially.

The most nearly agouti specimen of the Guayabal series serves to form an almost unbroken gradient in coloration between *zuliae* and the series of *griseogena* from San Julián. The topotype agrees more nearly than the others with specimens of *tarrae* from the upper Catatumbo.

GRAMALOTE (2 females): Specimens from 30 kilometers west of Cúcuta, 1,020 meters altitude, are quite intermediate in characters between the Guayabal *zuliae* and the series of *meridensis* from the Páramo de Tamá. As compared with the former they are smaller, with longer, thicker pelage, less black on upper parts, less red on

underparts. They are nearest *zuliae* but illustrate that the altitudinal gradients in size, color and pelage have the same tendencies in both the Gramalote and the Páramo de Tamá branches of the Río Zulia fluvial system.

PUERTO SANTANDER (male and female): These specimens from the right bank of the Magdalena, altitude 60 meters, are practically identical with specimens from El Guayabal; the female has the same white markings on underparts as described for one of the Guayabal squirrels.

Remarks.—The position of *zuliae* is strategic both geographically and with relation to other subspecies of *granatensis* which have heretofore been considered specifically distinct. The type locality, in the angle of the node formed by the union of the Perijá and the Mérida ranges, is a crossroad through which intergradation between extreme forms of *granatensis* is demonstrated. Pursuing the Mérida range northeastward gradation into the pale agouti, or olivaceous, *griseogena* can be shown. Northward, along the Perijá range and into the Maracaibo basin, gradation into the blackish (*tarrae*) and the orangeous and contrasting black (*perijae* and *maracaibensis*) squirrels has been demonstrated. Westward, across the mountains, we find again a gradient leading to the contrastingly colored, white bellied *variabilis*. Southward, into the higher levels of the Eastern Andes (Páramo de Tamá), *zuliae* leads to *meridensis* which, in turn, is hardly distinguishable from the forms known as *griseimembra* and *candalensis*; at middle levels southward in the Eastern Andes, *zuliae* undergoes only a very slight transformation to become known as *chrysurus*.

Specimens examined.—Nine. Orope, 1 (C.N.H.M.); El Guayabal, 10 miles north of Cúcuta, 4 (C.N.H.M.); Gramalote, 2 (U.S.N.M.); Puerto Santander, 2 (U.S.N.M.).

SCIURUS GRANATENSIS GRISEOGENA (Gray)

Macrozux griseogena GRAY, Ann. Mag. Nat. Hist., ser. 3, vol. 20, p. 429, 1867.

Sciurus griseogena klagesi THOMAS, Ann. Mag. Nat. Hist., ser. 8, vol. 14, p. 240, 1914 (Galifare, near Caracas).

Type.—According to Allen (1915, p. 227) one of the specimens collected by Dyson in Venezuela and so indicated by Thomas on the label of the specimen. It has never been formally recorded as a lectotype.

Type locality.—Venezuela, designation by Thomas (1901, p. 193). Here further restricted to San Julián, near La Guaira, coast of Venezuela (see discussion *antea* p. 7).

Distribution.—Coast and low coastal ranges of Carabobo and the Caracas district, northern Venezuela.

Characters.—Pale agouti, olivaceous in appearance, with or without

a dark median dorsal band. Smaller and paler than *zuliae*, and without contrasting shoulder regions, pelage longer and softer.

Coloration.—Dorsum, sides of body and hind legs ticked with black and orange-buff to capucine yellow, a darker median dorsal band when present, weakly to moderately well-defined; sides of arms with more red; fore and hind feet orangeous lightly mixed with black to evenly agouti or nearly black. Underparts cadmium orange to orange-rufous. Basal portion of tail like back, tip black, middle portion orange above, below uniformly orange to more or less defined tricolor (orange, black, grizzled yellow, and black).

Remarks.—In referring *klagesi* to *griseogena*, Allen is followed. According to the original description, *klagesi* is a long-haired highland form paler than either *griseogena* or *meridensis*. Possibly it could be assigned to either race, and, in the light of present material, *klagesi* would seem to be an annectant population.

The most immediate affinities of *griseogena* are with *chapmani* and the Andean *meridensis* rather than with the coastal *maracaibensis*. It appears to be well isolated geographically from that coastal neighbor, and differs from it notably. At present, gradation between the two can be shown only through the intermediacy of *zuliae*.

Specimens examined.—Twenty. San Julián, 18 (U.S.N.M.); "Venezuela," 2 (U.S.N.M.).

SCIURUS GRANATENSIS MERIDENSIS Thomas

Sciurus griseogena meridensis THOMAS, Ann. Mag. Nat. Hist., ser. 7, vol. 7, p. 192, 1901.

Sciurus griseogena tamae OSGOOD, Publ. Field Mus. Nat. Hist., zool. ser., vol. 10, p. 48, 1912 (Páramo de Tamá).

Holotype.—Adult male, skin and skull, B.M. No. 98. 7. 1. 33; collected November 16, 1896, by Briceño.

Type locality.—Escorial, Sierra de Mérida, near Mérida, Venezuela; altitude approximately 2,500 meters.

Distribution.—Middle and upper levels of the Sierra de Mérida.

Characters.—Pelage longer and thicker, underparts redder than *griseogena*; ventral surface with or without patches of white, dorsum with tendency to contrasting shoulder regions, tip of tail black.

Remarks.—The specimens from Páramo de Tamá, described as *tamae*, average paler than the topotype series. They also tend to show a slightly sharper contrast in the shoulder regions, thus indicating more clearly integration with *zuliae*.

The characters of *meridensis* are representative of the species as found in the higher levels of the Andes. These squirrels are comparatively small, thickly furred and olivaceous in appearance. Their underparts are usually uniformly red or orange but in individuals, patches of white may show. Local populations have been described

from widely separated points at altitudes ranging between 2,000 and 3,000 meters along the eastern Andes of Colombia and Ecuador. They form a fairly homogeneous group and nowhere can such sharp differences be found between any two of them as between two such neighboring coastal forms as *griseogena* and *maracaibensis*. Nevertheless, all along the lower borders of the range of these dusky highland squirrels, forms have been described which connect them with the larger, brightly colored coastal, or lowland, animals. It has been shown that *meridensis*, by way of the series from the Páramo de Tamá, grades into the lowland *maracaibensis* through the races *zuliae* and *tarrae*. In Ecuador the highland *carchensis* shows gradation into the coastal *versicolor* through the races *söderströmi* and *imbaburae* which occupy successively lower altitudinal levels. At the northern extreme of the Eastern Andes it has been noted that the longer-haired paler and more uniformly agouti representatives of *perijae* resemble individuals of *meridensis*. The former subspecies includes also individuals which lead to the lowland *maracaibensis* on one side and *splendidus* on the other.

Specimens examined.—Eleven. Montes de Escorial, Mérida, 2,500 meters, 2 (U.S.N.M.); Montes de la Culata, Mérida, 2,500 meters, 1 (U.S.N.M.); Montes de Hechizera, 2,000 meters, 1 (U.S.N.M.); Paramo de Escorial, 3,000 meters, 1 (U.S.N.M.); Montes de Chama, Mérida, 1,600–1,700 meters, 2 (U.S.N.M.); Montes de la Sierra, Mérida, 2,000 meters, 1 (U.S.N.M.); Páramo de Tamá, 8,000 feet, 3 (C.N.H.M.).

GEOGRAPHIC VARIATION

A complete picture of the geographic variation within the species cannot be given here. The following discussion is based primarily upon the squirrels collected by the author in a small corner of the range in northern Colombia and some complementary material collected by others in adjacent regions. Of necessity, some references are made to more distantly located specimens. The localities from which squirrels are at hand represent almost completely all the major ecological subdivisions frequented by squirrels in the area under consideration (see map, fig. 1). The only important ecological community not satisfactorily represented is that of the highest altitudinal levels inhabited by squirrels in the Sierra Nevada de Santa Marta. A brief description of each of the collecting localities is given in the gazetteer (p. 40).

Commencing with the squirrels taken in the lowlands of the Río Magdalena, we find members of each of three markedly differentiated subspecies occupying adjoining ranges and subjected to the same environmental conditions. The type localities of these three races have been established at points so near to each other that an energetic

collector, with the aid of a canoe, could secure topotypes of all three forms in the same day. Norosí, the type locality of *norosiensis*, is situated in the Río Magdalena Valley at the foot of the Cordillera Central. Twenty-five kilometers east, on the opposite shore of the Magdalena near the base of the Cordillera Oriental, is La Gloria, type locality of *variabilis*. Forty-five kilometers downstream at the mouth of the Cesar is the type locality of *splendidus*. The genetic distinctiveness of *norosiensis* from the two races on the opposite side of the river may be explained on the basis of geographic isolation. The Río Magdalena at this point is hemmed in by the eastern and central Andes, its valley is relatively narrow and its main channel is much less subject to change than lower down in the flatlands. Though the differences which separate *variabilis* from *splendidus* are obvious, the geographical conditions that keep them separate are less clear. It seems, however, that the elbow of the Cordillera Oriental which marks the division of the Cesar Valley of the lower Río Magdalena from the valley of the middle Magdalena serves to isolate partially, at least, the two forms.

In the separate discussion under the subspecific headings it has been shown that on higher altitudinal levels of the Cordillera Oriental where the geographic barriers mentioned become neutralized, these three subspecies converge through a series of gradations into one and the same thing. Southward, up the Magdalena and eastward onto the Cordillera Oriental, *variabilis* becomes smaller and darker, the belly red, to grade into *zuliae* and *tarrae*, respectively. *S. g. norosiensis* must become only slightly smaller and darker up the Magdalena along the eastern slope of the Cordillera Central and across the Magdalena to the western slope of the Cordillera Oriental, to merge with *chrysurus* and *zuliae*, respectively. The Río Cesar squirrel, *splendidus*, on the other hand, in continuing up the main course of the Cesar Valley to its head, becomes progressively paler and thus diverges even more widely from the typical forms of the other two subspecies. What occurs along the east bank of the lower Magdalena to its mouth is not known. Typical *granatensis* west of the mouth of the main channel is paler than *splendidus* but appears to be a well-marked local form restricted to the *ciénagas* surrounding the low foothills of the northern terminus of the Cordillera Occidental. It is completely isolated from all the other races described in this paper. In the Río Cesar, once the valley bed is left for the eastern mountain chain, again the squirrels become smaller and darker. In the mountains overlooking the head of the Cesar *splendidus* intergrades with *perijae* which, in turn, intergrades with *tarrae*. Lower down, on the southwestern portion of the Sierra de Perijá, it may be confidently assumed that intergrading populations of *splendidus*, *variabilis*, *perijae*, and *tarrae* all occur.

A situation somewhat analogous to the above is presented by that of *maracaibensis* of the Maracaibo Basin and *griseogena* of the hilly northern coast of Venezuela. They are widely differing forms whose habitats are separated from each other by outlying ranges of the Cordillera de Mérida. The two races may intergrade along the coast, but no specimens are available from intermediate points to determine this. It has been shown, however, that both *maracaibensis* and *griseogena* grade into *zuliae*.

The squirrels from the eastern and southern slopes of the Sierra Nevada de Santa Marta show clearly their origin from the lowland *splendidus*. Like the others, they become progressively smaller and darker, or agouti, with increasing altitude. Unlike the squirrels of the Cordillera Oriental, however, their underparts are consistently sharply defined white, as in *splendidus*.

The squirrels of the highest forested altitudinal levels of the eastern Andes are of special interest. They are thickly furred, dusky, and more or less uniformly agouti. They contrast markedly with the larger, brightly colored squirrels of the lowlands. So different is their appearance that they have been described as specifically distinct. It seems, however, that each population of these highland squirrels has been derived directly from the squirrels of the next lower altitudinal zone. In the absence of any barrier over a large, well-defined area of the highlands, the several heterogeneously derived populations may merge into a distinct and homogeneous group. This obscures the fact that each population is the end product of a convergent, altitudinal cline which may have started, as in the case of *variabilis*, *splendidus*, and *norosiensis*, from three widely divergent forms in the lowlands. Examples of two populations of *meridensis* were examined. One series is from the Sierra de Mérida, the other from the Páramo de Tamá. The former shows direct gradation into *griseogena* while the latter shows its derivation from specimens of *zuliae* farther down the same river system. Similarly, *griseimembra*, of the páramos above Bogotá, though hardly distinguishable from *meridensis*, represents a terminus of the altitudinal gradient of which *chrysurus* of Bogotá is next below.

In the above it has been noted that at higher altitudinal levels the lowland squirrels are represented by smaller forms. This tendency to reduction in size is continuous, frequently *pari passu*, to the highest altitudinal levels inhabited by the squirrels of the species. We have seen that the lowland forms are represented by darker ones at the next higher altitudinal zone. Where the lowland form is contrastingly colored, black and reddish, the next altitudinally higher one is less contrasted due to the augmentation or more even distribution of the black pigment of the body. This suppresses, to varying degrees, the otherwise contrastingly reddish sides and shoulder regions. Where

the lowland form is quite, or nearly, uniformly reddish or orangeous, as in *splendidus*, the next higher form by the acquisition or increase of the black pigment becomes contrastingly colored. Finally, the lowland agouti forms (*norosiensis*) become darker agouti at the next higher levels. From these levels where the darker forms occur to the highest forested zones the length and thickness of the pelage increases. The reddish subterminal band of the hair becomes narrower and frequently paler or even yellowish, while the longer gray basal portions of the hairs tend to show through at the surface. This results in a paler, uniformly agouti, or olivaceous appearing animal. The underparts follow the same tendencies (except in the Sierra Nevada de Santa Marta). From the lowlands to the next altitudinally higher levels, reddish underparts are generally followed by deeper red underparts, white underparts by red, or mixed red and white underparts. At the highest levels, the red may persist, it may become yellow, or mixed red or yellow with white.

TABLE 1.—*Types of color patterns occurring among the populations of the subspecies Sciurus granatensis*

[In series with three or more color patterns the dominant ones are italicized. Altitudes given are those of the specific localities or represent the altitudinal range between which the squirrels were taken. See p. 9 for explanation of symbols]

Subspecies	Locality	Altitude	Number of specimens	Color-pattern symbols
		<i>Meters</i>		
<i>variabilis</i>	La Gloria.....	45	3	4b-4bc.
<i>variabilis</i>	Agua Chica.....	162	2	4bc.
<i>zuliae</i>	Puerto Santander.....	60	2	4bc.
<i>tarrae</i>	Guamalito.....	600-1,000	7	4bc-3b-3a.
<i>tarrae</i>	Tarra.....	200-350	10	4bc-3b.
<i>zuliae</i>	El Guayabal.....	150	4	4bc-3b.
<i>zuliae</i>	Orope.....	25	1	4bc.
<i>maracaibensis</i>	Maracaibo.....	0-10	3	4bc.
<i>perijae</i>	Las Marimondas.....	800-1,500	16	4bc-4ac.
<i>perijae</i>	Sierra Negra.....	1,000-1,500	30	1-4bc-4ac-3b-3a.
<i>splendidus</i>	Villanueva.....	274	5	1-2.
<i>splendidus</i>	Nazaret.....	200	1	2.
<i>splendidus</i>	Río Cesar.....	140-158	66	1-2.
<i>splendidus</i>	Puerto Estrella.....	36	3	1.
<i>granatensis</i>	Guájaro.....	15	14	2-4b.
<i>agricolae</i>	Colonia Agrícola.....	250-800	17	1-2-4ac-4a.
<i>agricolae</i>	El Salado.....	350-850	20	1-2-4ac-4a-4bc.
<i>saluensis</i>	Pueblo Bello.....	1,000-1,200	17	1-3a-4ac-3b-4bc.
<i>bondae</i>	Bonda.....	50	16	3a-4ac-4a.
<i>griseogena</i>	San Julián.....	Near sea level	19	3a-3b.
<i>meridensis</i>	Mérida.....	1,600-2,500	8	3a-3b.
<i>meridensis</i>	Tamá.....	2,433	3	3a-4ac.
<i>zuliae</i>	Gramalote.....	1,020	2	4ac-4b.
<i>norosiensis</i>	Norosi.....	90-120	10	3a-4ac.
<i>norosiensis</i>	San Pedro.....	150-250	10	3a-4ac-3b.

Table 1 shows the intergradation in color patterns. The localities have been arranged in an order showing geographical continuity. Where this continuity is broken, as between the Bonda series from the Sierra Nevada de Santa Marta and the San Julián series from northern Venezuela, a space on the chart separates their localities. The symbols for the patterns are explained on page 9. It will be noted that the color pattern does not describe the particular color tone or color phase on the dorsum, or the color of the underparts. Nevertheless, as shown in the descriptions and discussions, the gradations in the colors themselves, both of upper and lower parts, the extremities included, coincide with those of the color patterns.

SUPPLEMENTARY LIST OF THE SOUTH AMERICAN SUBSPECIES OF
SCIURUS GRANATENSIS Humboldt

Unless otherwise indicated, the types and additional material including topotypes of the following named forms have been examined by the author.

SCIURUS GRANATENSIS GERRARDI Gray

Sciurus gerrardi GRAY, Proc. Zool. Soc. London, 1861, pt. 1, p. 92, pl. 16, 1861.

Type locality.—New Grenada. Restricted by Allen (1915, p. 308) to "somewhere between the ranges of the *zuliae-cucutae* group . . . and . . . *baudensis* in northern Colombia."

Remarks.—Allen referred a specimen from the Río San Jorge, Bolívar, to *gerrardi*. Two squirrels, one from Montería, another from Jaraquíel, both on the Río Sinú, Bolívar, agree with the color plate of *gerrardi*. They are more red than typical *granatensis* and the tails of both are tipped with black. The specimens, collected by Carriker in 1916, are preserved in the Carnegie Museum.

SCIURUS GRANATENSIS SALAQUENSIS Allen

Sciurus gerrardi salaquensis ALLEN, Bull. Amer. Mus. Nat. Hist., vol. 33, p. 592, 1914.

Mesosciurus gerrardi baudensis ALLEN, Bull. Amer. Mus. Nat. Hist., vol. 34, p. 308, 1915 (Baudo).

Type locality.—Río Salaquí, a tributary of the Atrato, northern Chocó, Colombia.

Remarks.—Doubtfully separable from *morulus* Bangs.

SCIURUS GRANATENSIS VALDIVIAE (Allen)

Mesosciurus gerrardi valdiviae ALLEN, Bull. Amer. Mus. Nat. Hist., vol. 34, p. 309, 1915.

Type locality.—Puerto Valdivia, lower Río Cauca, Antioquia, central Colombia; altitude 360 feet.

SCIURUS GRANATENSIS LEONIS Lawrence

Sciurus milleri ALLEN, Bull. Amer. Mus. Nat. Hist., vol. 31, p. 91, 1912 (pre-occupied).

Sciurus gerrardi leonis LAWRENCE, Journ. Mamm., vol. 14, p. 369, 1933.

Type locality.—Cocal, western slope of Cordillera Occidental, upper Río San Juan region, Cauca Department, southwestern Colombia.

Remarks.—Questionably distinct from *inconstans*.

SCIURUS GRANATENSIS VERSICOLOR Thomas

Sciurus versicolor THOMAS, Ann. Mag. Nat. Hist., ser. 7, vol. 6, p. 385, 1900 (pre-occupied).

Sciurus gerrardi inconstans OSGOOD, Journ. Mamm., vol. 2, p. 40, 1921 (new name for *versicolor* Thomas, "preoccupied" by *versicolor* Zimmerman, Spec. Zool. Geogr., p. 520, 1777. Zimmermann's name not valid).

Type locality.—Cachaví, upper Río Cachaví, Esmeraldas Province, northwestern Ecuador; altitude 500 feet.

SCIURUS GRANATENSIS MANAVI (Allen)

Guerlinguetus hoffmanni manavi ALLEN, Bull. Amer. Mus. Nat. Hist., vol. 33, p. 589, 1914.

Type locality.—Río de Oro, about 60 miles from the coast, Manaví Province, western Ecuador.

SCIURUS GRANATENSIS QUINDIANUS (Allen)

Guerlinguetus hoffmanni quindianus ALLEN, Bull. Amer. Mus. Nat. Hist., vol. 33, p. 587, 1914.

Type locality.—Río Frío, western slope of Cordillera Central, on east bank of Río Cauca, Valle del Cauca Department, central Colombia; altitude 3,500 feet.

SCIURUS GRANATENSIS CHRYSURUS Pucheran

Sciurus chrysurus PUCHERAN, Rev. Zool. Paris, 1845, p. 337 (type an immature).

Sciurus hyporrhodus GRAY, Ann. Mag. Nat. Hist., ser. 3, vol. 20, p. 419, 1867 (Santa Fé de Bogotá).

Type locality.—"Santa Fé de Bogotá," central Colombia.

SCIURUS GRANATENSIS GRISEIMEMBRA (Allen)

Guerlinguetus griseimembra ALLEN, Bull. Amer. Mus. Nat. Hist., vol. 33, p. 589, 1914.

Type locality.—Buenavista, eastern slope of Cordillera Oriental, southeast of Bogotá, Cundinamarca, central Colombia.

SCIURUS GRANATENSIS CANDALENSIS (Allen)

Guerlinguetus candalensis ALLEN, Bull. Amer. Mus. Nat. Hist., vol. 33, p. 590, 1914.

Type locality.—La Candela, near San Agustín, Huila, south central Colombia; altitude 6,500 feet.

SCIURUS GRANATENSIS CARCHENSIS Harris and Hershkovitz

Sciurus candelensis [sic] *carchensis* HARRIS and HERSHKOVITZ, Occ. Pap. Mus. Zool. Univ. Michigan No. 391, p. 3, 1938.

Type locality.—Atal, Montúfar, near San Gabriel, Carchi Province, northern Ecuador; altitude about 2,900 meters.

SCIURUS GRANATENSIS SÖDERSTRÖMI Stone

Sciurus hoffmanni söderströmi STONE, Proc. Acad. Nat. Sci. Philadelphia, vol. 66, p. 14, 1914.

Notosciurus rhoadsi ALLEN, Bull. Amer. Mus. Nat. Hist., vol. 33, p. 585, 1914 (Pagma Forest, central Ecuador, immature of *söderströmi*).

Type locality.—Mount Pichincha, near Quito, central Ecuador.

SCIURUS GRANATENSIS IMBABURAE Harris and Hershkovitz

Sciurus gerrardi imbaburae HARRIS and HERSHKOVITZ, Occ. Pap. Mus. Zool. Univ. Michigan No. 391, p. 1, 1938.

Type locality.—Peñaherrera, Intag, western Imbabura Province, western Ecuador; altitude 1,500 meters.

SCIURUS [GRANATENSIS] FERMINAE Cabrera

Sciurus ferminae CABRERA, Trab. Mus. Nac. Cien. Nat., Madrid, vol. 31, p. 49, 1917.

Type locality.—Baeza, eastern slope of Cordillera Oriental, north-eastern Ecuador.

Remarks.—Provisionally assigned to *granatensis* on basis of original description. No specimens were seen.

SCIURUS [GRANATENSIS] SUMACO Cabrera

Sciurus sumaco CABRERA, Trab. Mus. Nac. Cien. Nat., Madrid, vol. 31, p. 51, 1917.

Type locality.—San José, on the flanks of Mount Sumaco, north-eastern Ecuador.

Remarks.—Provisionally assigned to *granatensis* on basis of original description. No specimens were seen.

SCIURUS GRANATENSIS CHAPMANI Allen

Sciurus chapmani ALLEN, Bull. Amer. Mus. Nat. Hist., vol. 12, p. 16, 1899.

Sciurus (*Guerlinguetus*) *quebradensis* ALLEN, *ibid.*, p. 217 (Quebrada Seca, northern Venezuela).

Type locality.—Caparo, Trinidad.

SCIURUS GRANATENSIS TOBAGENSIS Osgood

Sciurus tobagensis OSGOOD, Publ. Field Mus. Nat. Hist., zool. ser., vol. 10, p. 27, 1910.

Type Locality.—Island of Tobago, British West Indies.

SCIURUS GRANATENSIS NESAEUS G. M. Allen

Sciurus nesaeus ALLEN, Proc. Biol. Soc. Washington, vol. 15, p. 93, 1902.

Type locality.—El Valle, Margarita Island, Venezuela.

TABLE 2.—*External and cranial measurements of the subspecies of Sciurus granatensis of northern Colombia and northwestern Venezuela*

[Measurements in millimeters, of adult specimens only. The measurements for each character show the mean, the extremes (in parentheses), followed by the number of specimens measured.]

Subspecies and locality	Head and body	Tail	Hind foot	Ear (from notch)	Condylbasal length	Zygomatic breadth
<i>variabilis</i> :						
La Gloria.....	240. 3 (229-249) 3	224. 7 (211-242) 3	59. 7 (58-61) 3	30. 7 (30-31) 3	53. 1 (51. 5-54. 7) 2	33. 6 (33. 6-33. 7) 2
<i>splendens</i> :						
Río Cesar.....	242. 7 (200-266) 52	240. 0 (203-269) 50	61. 2 (56-65) 52	31. 0 (26-36) 52	53. 2 (51. 3-56. 2) 44	33. 4 (31. 0-35. 3) 42
Villanueva.....	243. 6 (237-250) 5	249. 8 (238-265) 5	61. 0 (60-63) 5	31. 2 (30-32) 5	52. 8 (51. 8-53. 7) 5	33. 4 (32. 5-34. 6) 4
<i>perijae</i> :						
Sierra Negra.....	232. 6 (222-250) 23	223. 6 (200-248) 21	58. 0 (55-61) 23	29. 2 (28-32) 23	50. 4 (48. 0-53. 1) 20	32. 0 (30. 4-33. 3) 20
Marlondas.....	220. 1 (207-231) 16	214. 9 (198-229) 15	56. 4 (54-59) 16	27. 7 (26-29) 16	48. 8 (46. 4-50. 4) 11	31. 3 (30. 5-32. 3) 12
<i>maracabensis</i> :						
Maracaibo.....	222. 0 (220-224) 2	214. 0 (200-228) 2	52. 5 (50-55) 2	(25) 1	51. 3 (51. 3-51. 4) 2	32. 7 (32. 2-33. 3) 2
<i>tarae</i> :						
Río Tarra.....	214. 4 (207-225) 9	202. 5 (191-218) 7	54. 7 (52-58) 9	26. 7 (25-28) 9	47. 8 (45. 8-51. 4) 9	30. 9 (28. 9-32. 5) 9
Guamalito.....	223. 2 (209-240) 5	205. 2 (201-208) 5	57. 0 (55-58) 5	28. 4 (26-30) 5	49. 8 (48. 9-50. 5) 3	31. 8 (31. 3-32. 5) 4
<i>zuliae</i> :						
Río Zulia.....	215. 0 (207-222) 5	189. 6 (170-201) 5	54. 6 (51-59) 5	-----	50. 1 (47. 5-51. 8) 3	32. 1 (29. 5-33. 6) 3
Puerto Santander.....	-----	-----	-----	-----	51. 6 (51. 0-52. 3) 2	33. 7 (33. 0-34. 4) 2
Granalote.....	-----	-----	-----	-----	(48. 0) 1	(31. 4) 1
<i>metidensis</i> :						
Tamá.....	218. 7 (216-223) 3	181. 7 (176-193) 3	54. 0 (53-55) 3	-----	46. 8 (46. 1-47. 5) 2	(30. 8) 1
Merida.....	-----	-----	-----	-----	45. 2 (44. 1-47. 7) 3	29. 1 (27. 8-30. 7) 7
<i>griseogena</i> :						
San Julián.....	-----	-----	-----	-----	45. 5 (44. 6-46. 5) 12	29. 4 (28. 5-31. 4) 13
<i>granatensis</i> :						
Guájaró.....	228. 5 (215-264) 14	219. 3 (197-243) 14	57. 1 (54-59) 14	29. 0 (28-31) 14	50. 3 (48. 4-53. 0) 10	32. 3 (30. 0-33. 9) 9
<i>bondae</i> :						
Bonda.....	244. 7 (216-285) 10	229. 0 (195-252) 9	59. 1 (57-63) 9	-----	51. 2 (50. 6-51. 7) 8	32. 2 (30. 8-33. 3) 7
<i>agricolae</i> :						
Caracolicito.....	231. 6 (208-248) 16	221. 6 (198-240) 14	58. 1 (54-61) 17	29. 5 (28-31) 17	51. 2 (48. 0-52. 8) 13	32. 1 (29. 7-33. 0) 9
El Salado.....	231. 2 (212-250) 18	234. 8 (203-260) 17	58. 9 (56-61) 18	29. 7 (28-32) 18	51. 2 (47. 5-54. 3) 17	32. 3 (29. 9-34. 0) 15
<i>salutensis</i> :						
Pueblo Bello.....	224. 0 (210-245) 15	207. 9 (198-226) 15	56. 7 (55-58) 15	28. 1 (26-31) 15	49. 1 (47. 0-50. 0) 14	30. 9 (29. 8-32. 2) 14
<i>norotensis</i> :						
Norotí.....	244. 4 (213-268) 9	226. 0 (207-248) 9	61. 4 (60-64) 9	28. 8 (27-30) 9	52. 2 (49. 5-54. 5) 8	33. 6 (31. 9-34. 8) 7
San Pedro.....	244. 3 (234-263) 10	224. 1 (214-241) 8	62. 3 (60-65) 10	29. 6 (27-31) 10	54. 8 (53. 3-55. 9) 9	35. 0 (34. 0-35. 7) 9

Subspecies and locality	Nasals, length	Supraorbital constriction	Postorbital width	Braincase width	Molar row, alveolar length
<i>variabilis</i> :					
La Gloria.....	19.1(18.9-19.4) 2	17.8(17.7-17.9) 2	18.3(17.8-18.8) 2	23.3(22.8-23.7) 2	10.0(10.0-10.0) 2
<i>splendens</i> :					
Río Cesar.....	18.6(17.0-20.7) 29	18.6(17.0-19.9) 48	18.5(17.3-19.3) 47	23.3(22.0-24.4) 40	10.0(9.4-10.6) 47
Villanueva.....	19.3(18.7-19.6) 5	18.6(18.1-19.4) 5	18.6(18.3-19.3) 4	23.6(23.0-24.9) 5	10.1(10.0-10.2) 5
<i>perijae</i> :					
Sierra Negra.....	17.6(16.4-19.1) 19	17.6(16.2-18.9) 23	18.4(17.0-19.4) 21	23.2(21.8-24.0) 17	9.8(9.2-10.7) 19
Marimondas.....	16.3(15.8-17.2) 12	17.7(16.6-18.9) 14	18.1(17.2-19.2) 14	23.0(22.4-23.7) 12	9.3(8.4-10.0) 15
<i>maracabensis</i> :					
Maracabo.....	17.4(16.6-18.1) 3	17.6(17.0-18.0) 3	17.8(17.6-18.6) 3	22.7(22.3-23.1) 2	9.7(9.6- 9.8) 3
<i>tarrae</i> :					
Río Tarra.....	16.4(14.8-18.1) 8	16.4(15.5-17.3) 9	17.8(16.9-18.5) 9	22.4(21.2-24.0) 6	9.2(8.7-10.0) 9
Guamalito.....	16.7(16.4-17.2) 5	17.2(16.5-18.7) 5	18.2(17.6-18.8) 4	23.4(22.9-24.4) 4	9.2(8.8- 9.4) 5
<i>zuliae</i> :					
Río Zulia.....	17.6(16.9-18.3) 4	17.0(16.2-18.2) 4	18.1(17.3-18.7) 4	22.6(22.2-23.0) 2	9.9(9.6-10.1) 5
Puerto Santander.....	17.6(17.4-17.9) 2	18.5(18.4-18.7) 2	18.4(18.1-18.7) 2	23.4(23.4-23.4) 2	9.8(9.7- 9.9) 2
Gramalote.....	-----	(17.1) 1	(18.5) 1	(23.4) 1	(8.9) 1
<i>meridensis</i> :					
Tamá.....	15.9(15.6-16.1) 3	15.9(15.4-16.4) 3	18.7(18.6-18.8) 2	23.5(23.1-24.0) 2	9.2(9.0- 9.4) 3
Mérida.....	15.9(15.0-17.0) 7	15.8(14.5-16.6) 8	17.9(16.9-19.3) 7	22.3(21.6-23.3) 5	9.0(8.4- 9.4) 8
<i>griseogenae</i> :					
San Julián.....	16.0(15.1-17.1) 15	15.3(14.9-16.8) 13	18.0(17.2-18.8) 12	22.1(21.4-22.8) 9	9.0(8.6- 9.6) 15
<i>granatensis</i> :					
Guájaro.....	17.6(16.6-19.7) 12	17.8(16.8-19.1) 10	18.2(17.2-19.0) 10	23.7(23.3-24.0) 7	9.7(9.2-10.1) 12
<i>bondae</i> :					
Bonda.....	18.4(17.2-19.3) 9	18.3(16.8-18.9) 8	18.6(17.7-19.4) 8	23.3(22.9-24.0) 9	9.8(9.4-10.1) 10
<i>agricolae</i> :					
Caracollito.....	18.1(16.6-19.4) 12	18.1(16.5-18.7) 14	18.0(17.3-18.8) 14	23.0(22.3-23.9) 9	9.8(9.2-10.3) 14
El Salado.....	18.1(16.8-20.0) 16	18.0(16.0-19.5) 17	18.5(17.8-19.0) 17	23.5(22.5-24.5) 14	9.9(9.3-10.3) 17
<i>saltuensis</i> :					
Pueblo Bello.....	17.1(15.7-18.4) 14	17.1(15.7-17.8) 14	17.9(16.4-19.0) 13	23.0(22.0-23.6) 13	9.5(9.0-10.0) 14
<i>noronensis</i> :					
Noroná.....	18.0(16.5-19.0) 7	17.8(16.4-18.9) 8	18.8(18.3-19.7) 6	23.8(22.8-24.3) 7	9.5(9.1-10.2) 8
San Pedro.....	18.4(17.2-19.7) 8	18.5(17.3-20.0) 9	18.9(17.2-19.8) 10	24.4(24.0-25.0) 8	9.6(9.3-10.5) 10

DESCRIPTIONS OF THE LOCALITIES MENTIONED IN THE TEXT

Localities marked with an asterisk (*) are the author's collecting stations. Others visited or seen by the author but where either no squirrels were taken or no collecting at all was done by him are marked with a dagger (†). For aid in compiling descriptions of some of the stations not visited by the author in the Santa Marta district and in Venezuela, information was taken from Carriker, in Todd and Carriker (1922), and from Osgood (1912), as well as other reliable sources. Unless otherwise indicated, the name of the collector, or remitter, of the squirrels examined is given in parentheses at the end of each description. A complete account of the collecting stations and itineraries of the author in northern Colombia will be given in the final report on the collection.

Agua chica (162 meters), 8°18' N., 73°37' W., Magdalena, Colombia. A large town at the base of the Cordillera Oriental about 14 kilometers east of the Río Magdalena port, Gamarra (Carriker).

Bonda† (50 meters), 11°17' N., 74°7' W., Magdalena, Colombia. A small village on the Río Manzanares, between 8 and 9 miles east of Santa Marta, in the Sierra Nevada de Santa Marta region. The country lies in the semiarid coastal belt and is covered, in great part, with dry forest with intervals of open grass land on the ridge. Brown collected here, working along the river valley and on the mountain slopes to the southeast up to 6,000 feet or more. His specimens are all labeled "Santa Marta" or "Santa Marta Mountains." This village was Smith's headquarters. Most of his collecting was done at somewhat higher elevations.

Cartagena† (sea level), 10°26' N., 75°31' W., Bolívar, Colombia. Important seaport of the Caribbean. Also, the name formerly applied to the whole of what is now the department of Bolívar. Humboldt landed at Cartagena from Cuba on his way to Bogotá *via* the Río Magdalena. To escape the bad climate of Cartagena while preparing for this trip, he stayed most of the time in the nearby village of Turbaco.

*Ciénaga de Guájaro** (15 meters), 10°37' N., 75°2' W., Atlántico, Colombia. A large shallow lake between Barranquilla and Cartagena, varying from 10 to 20 meters above sea level, according to season. It is part of the lower Río Magdalena swamplands. The low hills surrounding the lake attain a maximum height of 520 meters and are isolated prolongations of the Andean Chain. The region is characterized by pastures, palm groves, and patches of low, thick, scrubby forest, mainly *rastrojo*, the whole interspersed with small cultivated plots, chiefly cornfields. Semiarid tropical zone; the dry season lasts from the end of November into April. Author's camp situated on higher ground, about 50 meters altitude, near the village of Arroyo de Piedra.

Cincinnati† (1,480 meters), 11°9' N., 74°2' W., Magdalena, Colombia. A coffee plantation on the western slopes of Mount Lorenzo, Sierra Nevada de Santa Marta. It was known as Valparaiso when Smith and Brown collected there. Carriker began working there in 1911. The plantation lies between altitudes of 900 to 1,700 meters and involves the dry tropical forests as well as the humid subtropical forests.

- Colonia Agrícola de Caracolicito** (335 meters), 10° 18' N., 74° W., Magdalena, Colombia. An agricultural colony established by the Colombian government in the valley of the middle Río Ariguaní on the southern slope of the Sierra Nevada de Santa Marta. The region has been alternately cultivated and abandoned by the Indians since pre-Columbian times and most of the present forest, which is again being cut over, is not virgin. The region is well drained and highly accidented; the hills enclosing the valley rise to over 1,000 meters above sea level.
- Don Diego* (sea level), 11°15' N., 73°43' W., Magdalena, Colombia. An old plantation on the north coast at the mouth of the Río Don Diego. The region is humid and heavily forested (Carriker).
- El Guayabal†* (150 meters, approximately), 8°1' N., 72°31' W., Norte de Santander, Colombia. A station 14 kilometers by rail north of Cúcuta on the railroad line to Puerto Villamizar. It is located on the banks of the Quebrada de la Florista, a tributary of the Zulia. The conditions are intermediate between the arid scrubland of Cúcuta and the humid forests about Puerto Villamizar. Collecting may have been done at 1,000 feet above sea level, but the station itself is at a considerably lower altitude than Cúcuta with an elevation of 215 meters (Osgood and Jewett).
- El Orinoco, Río Cesar** (158 meters), 10°9' N., 73°26' W., Magdalena, Colombia. Camp on the main channel of the Río Cesar. A tropical, forested floodland area with many large open pastures on both banks. Cattle from the interior are driven here to graze during the dry season (December through May).
- El Panorama, Río Aurare* (sea level), Zulia, Venezuela. A site on the Río Aurare, southeast of Altagracia. It is on the higher ground of the arid region adjacent to the swamps and manglars on the east side of Lake Maracaibo (Osgood and Jewett).
- El Salado** (430 meters), 10°22' N., 73°29' W., Magdalena, Colombia. A collecting station on the mule trail about halfway between Pueblo Bello and Valencia, on the eastern slope of the Sierra Nevada de Santa Marta. The site is in the center of a broad belt of forest and *rastrajo* which separates the savannas of the Río Cesar Valley from those of Pueblo Bello.
- Encontrados* (10 meters), 9°4' N., 72°14' W., Zulia, Venezuela. A town at the junction of the Ríos Zulia and Catatumbo in the humid tropical plain southwest of Lake Maracaibo (H. F. Raven).
- Gramalote* (1,020 meters), 7°53' N., 72°47' W., Norte de Santander, Colombia. A town on a tributary of the Río Zulia about 30 kilometers west of Cúcuta (Hermano Nicéforo María).
- Guaimaral, Río Cesar** (140 meters), Magdalena, Colombia. A *caño* or channel west of the main channel of the Río Cesar. Camp about 5 kilometers east of El Orinoco. Heavily forested and more frequently flooded than the El Orinoco area.
- Guamalito** (600 meters, approximately), 8°34' N., 73°27' W., Norte de Santander, Colombia. A station about 3 kilometers below the town of El Carmen; it is in the semiarid deforested valley of the Río del Carmen on the western slope of the Sierra de Perijá. Some dry forest exists in the ravines of the opposing slopes of the valley but a more humid and heavier forest occurs on the summits and outer slopes of the ranges forming the valley. Much of the collecting was done in these forests, to an altitude of 1,000 meters.
- La Gloria** (45 meters), 8°37' N., 73°48' W., Magdalena, Colombia. River port on the right bank of the Magdalena. Collecting was done at Puerto Sagoc about 2 kilometers lower down. This region, in the valley between the foot of the Cordillera Central and the Cordillera Oriental, marks the end of the middle Río Magdalena before it joins the Cauca and spreads into the vast flood plain of its lower course.

- Laguna de Junco*† (2,240 meters), 10°32' N., 72°54' W., Magdalena, Colombia. In the Sierra Negra, on a hillside facing the Cerro Pintado (3,000 meters) from the north; about 7 kilometers southwest of the author's camp in the Sierra Negra and a kilometer and a half east of Carriker's base for ascending the Cerro Pintado. It is a small lake overgrown with rushes and completely dry during the dry season (Carriker).
- Las Marimondas** (1,000 meters, approximately), 10°52' N., 72°43' W., Magdalena, Colombia. Farm in the Sierra de las Marimondas near the summit of the Sierra de Perijá just south of the Montes de Oca. The locality is one of a few small coffee plantations in the drainage of the Río Ranchería. The mountain range here is low and narrow; its summits, which form the Colombia-Venezuelan boundary, range from 1,200 to 1,500 meters above sea level. Collecting was done on both sides at altitudes between 800 and 1,500 meters. Rain forest, from upper tropical to subtropical.
- Mamatoco*† (15 meters, approximately), 11°15' N., 74°9' W., Magdalena, Colombia. A village on the Manzanares, 4 miles east of Santa Marta. The area is one of low rocky hills and arid scrublands (Carriker).
- Minca*† (600 meters, approximately), 11°12' N., 74°4' W., Magdalena, Colombia. A station on the western slope of the Sierra Nevada de Santa Marta about 14 miles from Santa Marta on the road to Cincinatti at the point where it crosses the Río Gaira. It is in a zone between the arid scrublands of the lowlands and the humid mountain forest (Carriker).
- Mérida* (1,641 meters), 8°36' N., 71°9' W., Mérida, Venezuela. In the Sierra de Mérida; the city is situated on a mesa between the Río Chama and one of its tributaries, the Río Albaregas. In the valleys conditions are tropical to subtropical but mountains rise abruptly on either side and temperate forests are accessible within a few hours' travel. Briceño Gabaldán, a dealer in natural-history specimens, resided in one of the numerous coffee plantations surrounding the city. Most of the names of localities on the labels of his specimens are of these coffee plantations.
- Montes de Chama*, Mérida, Venezuela. Forests on the slopes of the Río Chama valley, near Mérida. The squirrels were taken between 1,600 and 1,700 meters above sea level (Briceño).
- Montes de la Culata*, Mérida, Venezuela. La Culata is the northern range of the Sierra de Mérida, north of the city of Mérida. The squirrels sent by Briceño came from the temperate zone forests (2,500 meters altitude), above the Río Chama. La Culata is also the name of a site 20 kilometers northeast of Mérida, altitude 4,487 meters, at the head of the Quebrada Mucujún.
- Montes de Escorial*, Mérida, Venezuela. Forests on the mountains near Mérida. Squirrels taken at 2,500 meters altitude (Briceño).
- Montes de la Sierra*, Mérida, Venezuela. Refers to some wooded area, in the mountains near the city of Mérida. Squirrels recorded from 2,000 meters (Briceño).
- Montes de Heckizera*, Mérida, Venezuela. Wooded area near the city of Mérida. Squirrels taken at 2,000 meters (Briceño).
- Nazaret* (200 meters), 12°11' N., 71°18' W., Guajira, Colombia. A mission situated at the base of the isolated Serranía de Macuire, at the tip of the Guajira Peninsula. The squirrel was taken by Wetmore and Carriker at an altitude of 800 feet. The Serranía attains a maximum elevation of 822 meters.
- Norosi** (120 meters), 8°39' N., 74°2' W., Bolívar, Colombia. A village at the northern foot of the Central Andes on the edge of the Río Magdalena swamp-lands. The forests here are broken by numerous pastures and small savannas. Collecting was done from the village itself, and from the site, "Candela," altitude 99 meters, in the swampland on left bank of the Río Norosí below the village.

Orope (25 meters), 8°27' N., 72°19' W., Zulia, Venezuela. A railroad station on the Rfo Orope, 8 kilometers east of where the Rfo Zulia crosses the Colombia-Venezuelan boundary. It is in the humid tropical forest at the northern base of the Sierra de Mérida in the Lake Maracaibo basin (Dearborn).

Palomino (or "*Palomina*"), 11°7' N., 73°34' W., Magdalena, Colombia. An Indian village on the northern slope of the Sierra Nevada de Santa Marta. It is on the right bank of the Rfo Palomino, northwest of Pueblo Viejo and about 15 kilometers up from the mouth of the river. Brown gave the altitude as 5,000 feet. This may be correct, but, according to Carriker, Brown never did collect there in person. The specimens were brought to him by an Indian trader.

Páramo de Escorial, Mérida, Venezuela. In the Sierra de Mérida; near the town of Mérida. *Páramo* refers, usually, to the grasslands of the high mountains above timber line. But the temperate forests above tropical or subtropical valleys are often called *páramos* by the valley inhabitants. The altitude of 3,000 meters given by Briceño for the squirrels is certainly above timber line in this area.

Páramo de Tamá, 7°24' N., 72°26' W., Colombia-Venezuela. A mountain mass in the Cordillera Oriental at the head of the Táchira River between Colombia and Venezuela. It supports a temperate-zone forest but the summit of the principal peak (3,329 meters) is without timber. Squirrels taken at 8,000 feet (Osgood and Jewett).

*Pueblo Bello** (1,067 meters), 10°24' N., 73°39' W., Magdalena, Colombia. A village on a savanna mesa between the upper Rfo Ariguaní and its tributary, the Ariguanicito, on the southern slope of the Sierra Nevada de Santa Marta. The whole region with the inner facing slopes of the surrounding hills is grassland except for isolated patches of forest in the ravines and precipitous slopes not suitable for agriculture or grazing. Obviously the region has been stripped almost bare of forest by repeated cutting and burning since pre-Columbian times. Savannas dominate the region from Pueblo Bello to San Sebastián and higher. The outer slopes of the hills to the west, south, and southeast are heavily forested. Humid subtropical.

This is the Pueblo Viejo (Sur) of maps and sometimes has been confused with the Pueblo Viejo where Brown collected.

Pueblo Viejo (853 meters), 10°59' N., 73°26' W., Colombia. A relatively new hamlet replacing the extinct village of San Antonio on the northern slopes of the Sierra Nevada. The village is on the Rfo San Antonio above its junction with the Rfo Macotama, whence it continues to the sea as the Rfo San Miguel. It lies among grass-covered hills between the tropical and subtropical zones. Several trails lead out of Pueblo Viejo, one of them west to the Indian village of Palomino. Brown gave the altitude of Pueblo Viejo as 8,000 feet. Due to this exaggeration in altitude, it was believed by Allen that Brown collected in Pueblo Viejo (Sur) on the southern slope of the mountains (see Pueblo Bello) which, though higher in altitude, is still much lower than 8,000 feet.

Puerto Estrella† (36 meters), 8°58' N., 73°56' W., Magdalena, Colombia. A small port on the right bank of the Magdalena, a few kilometers above El Banco, in the deltalike *ciénaga* forming the mouth of the Cesar (Curran).

Puerto Santander (60 meters), 7°45' N., 73°47' W., Santander, Colombia. Small port on the right bank of the Rfo Magdalena, on the pipe line between Barranca Bermejo and Gamarra (Hermano Nicéforo María).

- San Julián* (near sea level), 10°36' N., 66°51' W., Venezuela. On the warm, arid northern coast of Venezuela about 7 miles east of La Guaira. The hamlet, consisting of a few scattered huts, is located in an irrigated valley above the village of Caraballeda. The mountains behind San Julián are well forested (Robinson and Lyon).
- San Pedro, Río**, Bolívar, Colombia. A tributary of the Norosí entering on the left below the village of Norosí at the foot of the Central Andes. Collecting was done from the site Peñas de Navarro, altitude 178 meters. Region humid and heavily forested.
- San Sebastián†* (1,909 meters), 10°37' N., 73°34' W., Magdalena, Colombia. A picturesque Indian village in the fertile basin of the Río San Sebastián (Fundación) on the southern slope of the Sierra Nevada de Santa Marta. The surroundings are grass lands cut out of the original lower Temperate Zone forests. The land rises abruptly to the north, is extremely rocky, and continues through the páramos to the snow-capped peaks. The land to the south is hilly and grassy. The valley of the San Sebastián drops gradually westward, passing through beautiful humid forests. To the east there is a trail which leads through a pass and continues down the eastern slope of the mountain mass through a somewhat drier forest before ending in the semiarid valley of the Río Cesar (Brown).
- Santa Marta‡*, Colombia. Many old records given as "Santa Marta" do not necessarily refer to the town or to the "Santa Marta district" as now understood. During the period when present-day Colombia was known as New Granada, Santa Marta represented the western half of what is today the Department of Magdalena. It included the area east of the Río Magdalena from the Santa Marta Mountains south to the mouth of the Cesar. The eastern portion of the present department was, and still is, known as Valledupar. Specimens labeled "Santa Marta" by collectors who antedated Simon, Smith, and Brown are more likely to have been taken anywhere on the right bank of the Magdalena from its mouth to the confluence with the Río Cesar. Early specimens from the left side of the Magdalena may have been labeled "Cartagena," and correctly so, as the present departments of Atlántico and Bolívar were so known in the New Granadine period.
- "*Santa Marta Mountains*," Magdalena, Colombia. Specimens so labeled by Brown were taken anywhere from near Santa Marta, at sea level, to several thousand feet higher on the western slope of the Sierra Nevada de Santa Marta. See *Bonda*.
- Sierra Negra**, Magdalena, Colombia. The so-called "Black Mountains" or western range of the Sierra de Perijá overlooking the town of Villanueva in the semiarid Cesar Valley. The well-drained slopes of the range from 1,000 to 1,500 meters above sea level are given over almost entirely to coffee plantations. Higher up, to the summits, 1,500–3,000 meters, and eastward in Venezuela, virgin rain forests prevail; lower down, on the western slope, the country is semiarid with a mixture of grass and scrub. Collecting station, Pajalito, in the Sierra Negra was situated almost due east above Villanueva at an altitude of 1,265 meters.
- Tarra, Río** (200 meters, approximately), 8°36' N., 73°1' W., Norte de Santander, Colombia. A tributary of the upper Río Catatumbo on the eastern slope of the Sierra de Perijá, and not to be confused with the much larger Río Tarra of the lower Catatumbo in Venezuela. The author's collecting station was in the deep, broad, humid tropical valley of the Tarra in an abandoned road camp of the Colombian Petroleum Company. The region is almost continuously rainy except for a definite dry season from mid-December through March. It is densely covered with virgin forests and inhabited by a small population of the primitive Motilón Indians.

*Villanueva** (274 meters), 10°37' N., 72°58' W., Magdalena, Colombia. A town at the base of the Sierra Negra (Cordillera Oriental) in the upper Río Cesar valley. The region is semiarid with a scattering of low scrubby vegetation. There still remain, however, a few isolated stands of deciduous forest which once were continuous with the forests of the Magdalena.

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